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CENTRAL-STATION LECTURE SERVICE.

The good results attending lectures on electrical subjects by the central-station man and others capable of presenting their subjects in a popular, clear and interesting manner warrant more general consideration. The wonderful and rapid progress of applied electricity affords an almost endless series of texts for the speaker, and the business-getting possibilities of such work are very significant. In a recent case, where an experienced central-station lecturer appeared on the popular platform on an average of three times a week from January to June, it was found that in every instance new business developed from the lecture, the inquiries and subsequent applications for service being directly traceable to the interest stimulated by the man on the platform. Over and over again people became interested in electricity through the appeal of the lecture and its included lantern slides, and as soon as they realized that service could be had at rates far below the cost of luxuries, the response in new contracts signed at the office was immediate.

In a single instance where a lecture was given in a small town remote from the center of the system, the owner of a large residence applied during the evening for service involving over 200 lamps as a direct result of the speaker's talk and illustrations. Great interest has been awakened in electric cooking as a result of the lecturer's personal experience for three years with this method of preparing food for the table, and all along the line from the small appliance to the sizable motor, the outcome of effective popular presentations of the utility of electricity has been increased business for the central station.

It is obvious that the small central station cannot often undertake work of this kind single-handed, but there is little doubt that arrangements can be effected in most cases along co-operative lines with the larger city stations under which speakers trained in the service of the latter can be scheduled for occasional appearances outside their own territory in lyceum or other courses, or even under the immediate auspices of the local company. The field is well worth cultivating, for the reason that even the noted central stations of the country have still far to go before reaching the saturation point of new business in their communities, and in the smaller towns much more often remains to be done in proportion to the size of the staff.

One of the greatest factors in the success of the lecture in the small town is bound to be the comparatively

small number of evening events scheduled in any one season, whereas in the large city the appeal to be made most successfully must go to a prearranged audience like a woman's club, a lodge or a men's association, on account of the diversity of attractions in any single evening of the winter.

The use of demonstrating apparatus unquestionably has done a great deal of good in the popular lecture field, but there is some reason to believe that, given a first-class lecturer and an ample set of well arranged lantern slides chosen with an idea as to what will interest the public, as much good can be accomplished and at far less cost than where elaborate equipment is set up for temporary service. Of course, lectures on cooking or special fields of electrical service with professional demonstrators demand apparatus, but it is not necessary, even in the city, to go to large expense in order to interest non-technical audiences in central-station service. The lantern slide and sometimes the moving picture will do that, and people desiring more intimate personal knowledge of apparatus can generally satisfy it at the local company's office. The cost of transportation of elaborate demonstration apparatus is a matter worth considering, and while this journal would be one of the last to discourage utilizing actual demonstrations in the commercial department, it is certainly true that the possibilities of the old-fashioned stereopticon in the church parlor are by no means exhausted. Local circuits are frequently of inadequate capacity for the proper demonstration of elaborate equipment, and unless the conditions are favorable, it is far better to stick to the lantern slide than to attempt displays whose partial failure through lack of preparation may do more harm than good to the cause of popularizing electrical service.

MOTOR MAINTENANCE.

One of the advantages of motor drive with central-station service is the elimination of some of the labor necessary in a factory for attendance upon the steam engine or other machinery which is a feature of the isolated plant. While in a large factory it is usually advisable to have a skilled engineer about the premises, there are many small plants where this becomes unnecessary with motor drive, as the principal duty of such a man would be to keep the motors in good condition, and this service would not require the entire time of one man. In such small installations there is always danger that motors will not receive the little care and attention which should be theirs if they are to be kept in the best condition, and trouble avoided.

The desirability of expert outside service for such shops is pointed out in an article on page 931. An instance of such an arrangement is noted, where a firm dealing in motors also undertakes to maintain them in good operating condition. This is a service which is valuable to the small shop and such a proposition would undoubtedly be welcomed in nearly every community. It is something for the enterprising dealer or contractor to consider, and where there is no one in this business to undertake such a proposition, it might be advantageous for the central-station company to institute such service. The results, where properly managed, would be advantageous not only to the shop owner but also to the central station, since it would not only assist in maintenance of good service but would have actual advertising value through making central-station service completely satisfactory.

IMPROVING ELECTRIC POWER EXHIBITS.

Attendance at many electric shows suggests the desirability of putting more thought into the proper display of electric power applications in the future. In the lighting field remarkable exhibitions are given every year of the possibilities of new types of lamps and reflectors, shades and fittings, and the results from the commercial standpoint have unquestionably been more than satisfactory, generally speaking. There have been many excellent exhibits of motor-driven machinery also, but the point we desire to make is that on a good many occasions not enough has been made of the economic aspects of electric power applications. For example, hundreds of machines in no way related to the electrical industry have been shown at exhibitions merely set up on the floor of the booth, wired in the hastiest manner which the local inspectors would temporarily pass, and belted to some motor of nondescript lineage which was capable of turning over the apparatus. There has been a dearth of information in many such booths as to the actual savings accomplished by electricity under the most efficient conditions of driving, and the vital features of space economy as compared with mechanical methods, ease of control, facility with which speeds may be varied to suit the work, and not a few other points of importance have been left to the visitor's imagination.

There is, of course, a field for the exhibition of belted motors in power service; many machines are used successfully on such a basis, and in a great many cases, the group drive appears to be the proper solution of the motive power problem. We do not quarrel with the belt in favor of the gear or shaft drive, but do wish to emphasize the need of making electric power exhibits representative of the best practice, complete from the engineering standpoint, and interesting when viewed from the machine owner's side of the problem. It is better to display fewer machines and show those exactly as they are installed in the shop than to exhibit a large number of units admirable from the point of view of the machine designer but with an out-of-date drive due to the difficulties of the exhibition itself or to the indifference of the exhibitor. It is a safe guess that every manufacturer of electric motors possesses a wide range of interesting data regarding applications of this equipment, which have saved the purchaser

real money, increased his output, or in some way made operation safer and cleaner, releasing space formerly consumed to no good advantage by cumbersome methods of power supply. Now it is no very difficult matter to get some of this information printed on placards large enough to be read across an aisle of ordinary size, stating the size of machine displayed, the rating of the motor, and the gains in production or savings in cost secured by its use in some particular instance. If an advance in the method of attaching the motor to the machine has been made since the last exhibition, let this be indicated, at least by photographs of the old and new methods, with due explanatory notes in large type.

Improvements are continually being made in electric drives, and whether these be displayed singly from time to time in the central-station office window or in the full-fledged "show," too much care cannot be taken to have them represent the latest technical progress and commercial achievements. Nearly every machine is a successful candidate for electric driving, but the drive is the point to be featured in advertising electric service.

TOURING IN AN ELECTRIC ROADSTER.

A good deal has already been written respecting the noteworthy trip which Col. E. W. Bailey, Boston, Mass., has recently made in an electric vehicle of the roadster type. On other pages of this issue a complete report is made of the difficulties encountered and overcome at the various stages of the journey. While this presents a record of practically clear sailing, it has been developed under rigid cross-examination that had the weather conditions been at all pleasant the trip would have been practically without incident. The speed made under all conditions was well above that of ordinary gasoline practice, the average speed was greater than that allowed by the controls in long-distance touring, and Colonel Bailey states unreservedly that but very little useful time was wasted through the necessity of having to wait over for emergency charging of the storage batteries.

It is true that facilities for charging in some places were inadequate and considerable ingenuity had to be resorted to in order to get away without considerable delay. The important point is that the electric ran under its own power a distance of some 1,500 miles, and that no matter how great the difficulty might have been, charging facilities were in some way or another procured and the disposition upon the part of the central-station managers in every place where Colonel Bailey stopped was to the effect that if adequate facilities were not now available they would shortly be forthcoming.

The central-station managers of this country have been accused of indifference, apathy, cupidity, pin-headedness and all sorts of things opprobrious, because of their attitude toward the charging of storage batteries for electric vehicles. We realize that it is not an easy matter to provide facilities, which may run into considerable expense, for the occasional car which may come to town. With the demonstration that Colonel Bailey has made, however, that the thing is entirely possible, we have no doubt but that a great many central stations will take a pride in being ready even with a makeshift device to receive an electric-vehicle tourist with open arms, as it were, give him a full charge and send him on his way. With the proper co-operation between the electric-vehicle manufacturers and the manufacturers of accessories and the central-station managers, a co-operation which can be splendidly handled by the joint committees of the National Electric Light Association and the Electric Vehicle Association, electric touring will become very common. The time has passed, as the Colonel says, when it is anything of a "stunt."

COLLATERAL FOR CENTRAL-STATION LOANS.

In our notes regarding public service commissions there will be found this week reference to a memorandum which has been issued by the Board of Public Utility Commissioners of New Jersey. This memorandum called attention to two state laws which affect the deposit of public utility bonds as collateral for loans. In that state, as in several others, a statute provides that public utility corporations shall not issue obligations or securities except for cash or property of a value amounting to at least 80 per cent of the face value. It has been customary in some cases for utility companies to deposit their bonds as collateral when making loans and a court decision in Wisconsin has upheld the law declaring such bonds void when issued for less than a specified percentage of the par value. Under such circumstances it is apparent that the collateral gives no additional security to the creditor of the utility.

In states having a law similar to those in New Jersey and Wisconsin, such collateral deposit is not advantageous and in states where the commission is required to pass upon issues of bonds such deposit would be illegal unless the consent of the commission were obtained for the issue.

Since a public utility company ordinarily offers as little risk as the average merchant for an unsecured loan, there should be no difficulty in utility companies securing cash to meet special demands upon an ordinary promissory note, and the attitude of the banks in general is to treat such corporations upon the same basis as commercial houses. When such money is needed for permanent investment, as in extensions and improvements, a bond issue can be approved by the state commission when the amount and necessity of the expenditure is shown and from the proceeds of such notes can be taken up when they become due. The existence of such laws should, therefore, not handicap utility companies in obtaining necessary funds for legitimate purposes.

Dr. Steinmetz Addresses Chicago Electric Club.

Attendance records of the Electric Club of Chicago were broken on October 30 when 302 members and guests were present to hear the address of Charles P. Steinmetz on "The Electrical Industry." Dr. Steinmetz spoke in a popular vein, outlining the progress that has been made during the past 50 years by all civilized countries and pointing out the part that electricity plays in this advancement.

The railroads have been the greatest factor in progress in recent years as civilization itself depends almost entirely upon the transportation of energy and materials. The problem of the electrification of railroads is already more than half solved, according to Dr. Steinmetz, not by the replacing of electric for steam operation, however, but by paralleling steam roads with electric railways. The economical operation of steam roads he said is exactly opposite to the economical operation of electric railways, as in the former the trend is toward larger units, heavier trains and infrequent operation. This is because good efficiency is only possible in very large steam units whereas with electricity small motors are commercially equally as efficient as large machines. The greatest economy in electric traction will come with a distribution of the load over many units operating at frequent intervals.

Dr. Steinmetz commented at some length upon the ease with which electric energy can be converted into mechanical energy as compared with burning coal to generate steam to operate engines. This advantage of electric power is revolutionizing all industries and is lessening costs of all commodities.

Peter Junkersfeld, of the Commonwealth Edison Company, delivered the introductory address.

Henry M. Hyde, the well known author, will address the club on November 13, on "Relations Between the Press and the People."

Coming Meetings on Illumination.

The next meeting of the Chicago Section, Illuminating Engineering Society, will be held on November 12 in the auditorium of the Western Society of Engineers, Monadnock Block, at 8 p. m. The principal paper of the evening will be one by L. C. Porter, of Harrison, N. J., on "The Illumination of Street Railway Cars."

Beginning with this meeting there will be a series of "Twenty-Minute Talks on the Fundamentals of Illumination," by William A. Durgin.

The next meeting of the Philadelphia Section will be held at 8 p. m. on November 20. It will be a joint meeting with the ophthalmologists of Philadelphia and will be held at the College of Physicians and Surgeons. The following papers will be presented: "Some Effects of Artificial Light Upon the Eyes," by Edward A. Shumway; "The Effect of Mercury Arc Lamps Upon the Eyes," by George S. Crampton; "The Lighting of a Private Library," by A. J. Rowland.

Civil Service Examinations.

On December 1 the United States Civil Service Commission will hold an examination for senior telegraph and telephone engineer to fill vacancies in the Interstate Commerce Commission at salaries from $3,000 to $4,800 per annum and expenses, and in the second grade from $1,800 to $2,700. These positions are connected with the valuation of the property of common carriers. Applicants will not be assembled for examination. The ratings will be upon the basis of evidence adduced as to education, training and experience. Applicants must have had responsible experience in engineering and construction work relating to telegraph or telephone properties for at least ten years to be eligible to the first grade, and five years for the second grade. Applicants should secure Form 2039.

On the same date an examination will be held for telegraph and telephone inspector in the same branch of the service. Salaries in this position are from $1,200 to $1,800 in the first grade, and $720 to $1,080 in the second grade. Applicants will be rated for this position in the same manner as above. They must have had seven years of practical experience for grade one and two years for grade two. Applicants should secure Form 1800.

On December 3 there will be an examination for junior telegraph and telephone engineer at salaries ranging from $1,200 to $1,500 per annum for the first grade, and $720 to $1,080 for the second grade. Competitors will be examined on practical questions on electricity, installation tests, adjustments, interior and exterior wiring, etc.; also on education, training and experience. Four years of experience will be required for grade one, and two years for grade two. For grade one applicants must be between 25 and 40 years, and for grade two, between 21 and 35 years. Form 2039 should be secured.

On December 3 an examination will be held for telegraph operator, which is open to both men and women. Salaries in this position are $900 and $1,000 per year. The examination will involve spelling, arithmetic, penmanship, writing reports, copying and correcting manuscript, practical questions, training and experience.

Tennessee River Power Company to Dedicate Hale's Bar Hydro-electric Development.

Thursday, November 13, has been set as the date for the formal opening and dedication of the Chattanooga & Tennessee River Power Company's hydro-electric development at Hale's Bar on the Tennessee River near Chattanooga. A special program has been arranged by the Chattanooga Chamber of Commerce, which in addition to other entertainments, will provide a trip by river to the power house, lock and dam for the purpose of inspection. The power house, dam and lock were designed and constructed under the supervision of the United States Government engineers by the late Anthony N. Brady at a cost of $9,000,000. Seven years have been occupied in the completion of the work. The dam is 1,200 feet long and the lock is the highest single lift in the world, the height of the down-stream gates being 57 feet. The inside dimensions of the lock are 50 feet by 310 feet, and the power house is 356 feet long. The maximum capacity will be 65,000 horsepower. It is expected that the Secretary of War and other prominent Government officials will be in attendance, including the Senate Committee on Commerce, and the Rivers and Harbors Committee of the House. Paul J. Kruesi, vice-president of the Chattanooga Chamber of Commerce, is chairman of the Committee of Arrangements.

Jovians of Chicago Meet.

At the meeting of the Chicago Jovian Lunch Club on November 4, it was decided to change the day of the weekly luncheon from Tuesday to Monday and the next meeting will, therefore, be held on November 10. Victor Tousley, chief electrical inspector of the City of Chicago, will be the speaker on that occasion.

E. H. Waddington, in the absence of Homer E. Niesz, statesman for Chicago, presided at the meeting on November 4 at which several suggestions were made for the good of the Order in Chicago. A committee was appointed to select a suitable badge to be worn by Chicago members so that identification of a member would be facilitated at the meetings.

At the suggestion of S. A. Hobson it was decided to give each member an opportunity to speak before the club, preferably on the subject of his own business. Mr. Pierce of the Western Electric Company, inaugurated this practice by speaking briefly relative to the Christmas appliance campaign of his company.

Remarks were made by Perry Boole, George C. Richards, A. A. Gray and others.

William N. Matthews.

The time is easily in sight when the Jovian Order in point of numbers will be the largest organization in the electrical industry. With the greatest number of members and a field of development practically unlimited it is easy to imagine the Order becoming one of the greatest elemental forces in the accomplishment of better things for the electrical industry in the years to come. It seems as though the membership of the order has sensed the impending importance of this development, and like other significant movements in the history of all industries, when there is an opportunity for special service a man is found that measures up to the qualifications and requirements the opportunity presents. In the unanimous election of William N. Matthews, of St. Louis, as Reigning Jupiter of the Jovian Order, a wise and good thing has been done. Mr. Matthews is a co-operator of the most practical sort. He is a man of great ability, wide experience in business, has the esteem and holds the confidence of a great circle of acquaintances and friends, and has the time and wherewithal to give the right amount of attention to the matter.

Mr. Matthews was born in St. Louis in 1869. He was educated at Smith Academy. Following his graduation he went for a cruise on the United States Ship *Brooklyn*, as the guest of his uncle, the late Admiral E. O. Matthews, with whom he spent a year in Chinese waters. He subsequently became vice-president of the St. Louis Electrical Supply Company. After two years as a manufacturers' agent he engaged in the manufacture of electric specialties, taking his brothers, Claude L., and Leonard, Jr., into partnership with him in 1900. The latter, however, afterwards withdrew from the firm.

Mr. Matthews joined the Jovian Order in 1906, at Niagara Falls, and ever since has been an enthusiastic, loyal worker. He served in the Ninth Congress as Apollo, and as one of the organizers of the St. Louis League of Electrical Interests, Jovian Chapter, has done yeoman's work for the cause. As a practical evidence of his ideas of co-operation, he was one of the organizers and original members of the Electrical Supply Dealers' Association. Great as has been the development of the Jovian Order in the last four or five years, it is expected that under the reign of the present Jupiter totally unprecedented things will be accomplished.

William N. Matthews,
Reigning Jupiter of the Jovian Order.

Water Power Development on Skagit River.

The Secretary of Agriculture has granted to the Skagit Power Company a permit for the development of two water-power sites on the Skagit and Cascade Rivers in Skagit County, Wash., within the Washington national forest.

It is stated by officials of the company that construction work on the Skagit project will be commenced within a comparatively short time. The construction will consist of a concrete diverting dam, 50 feet in height, a tunnel conduit about 3.7 miles in length, and a power house on the Skagit River about 125 miles from Seattle, where most of the power output will be marketed.

In developing power from the Cascade River, the flow will be diverted by a concrete dam having a height of 20 feet and a maximum length of about 200 feet. Machinery capable of generating over 50,000 horsepower will be installed at the two power houses, according to the estimates of the engineers.

New Members of Society for Electric Development.

Unusual activity in various directions towards increasing the membership and funds of The Society for Electrical Development has been apparent in several sections of the country. Three well known men of large acquaintance in the electrical field have given their services to the society for special campaign work. They have covered the New England territory, Middle West and Southwest. Not only have they made individual calls upon electrical firms in all branches of the field, but they delivered addresses on the Society before a considerable number of electrical leagues and Jovian clubs.

Especially satisfactory returns both in the number of members and in the amount of subscriptions secured have been received through the personal efforts of W. E. Robertson, chairman of the society's campaign committee and the other members of that committee.

J. M. Wakeman, general manager of the Society for Electrical Development, delivered extended talks to the branch managers and resident agents of the General Electric Company, who were assembled in New York City; to a special Jovian committee in Philadelphia, which is making an active automobile canvass in that city; to the local jobbers' association in Philadelphia; to the New York Jovians at their regular weekly luncheon; and to the branch managers of the Public Service Electric Company, of New Jersey.

Among the larger companies which have made application for membership in the Society recently are the Crocker-Wheeler Company, Ampere, N. J.; the Hurley Machine Company, Chicago, Ill.; Doubleday-Hill Electric Company, Pittsburgh, Pa.; Capital Electric Company, Salt Lake City, Utah; The Electrical Supply & Equipment Company, Hartford, Conn.; Wheeler-Green Electrical Supply Company, Rochester, N. Y.; St. Paul Electric Company, St. Paul, Minn.; Mohawk Electrical Supply Company, Syracuse, N. Y.; and the Alpha Electrical Supply Company, New York City.

The results of the Jovian campaign which has been carried on during the past month are being tabulated and will be known within a few days. The campaign by the sales forces of various electrical manufacturing companies is well under way.

BOSTON TO CHICAGO—1,301 MILES—IN A BAILEY ELECTRIC ROADSTER.

Col. E. W. Bailey Makes Notable Run in an Electric Automobile.

What is without doubt the most notable run ever made by an electric automobile was recently consummated when Colonel E. W. Bailey, general manager of S. R. Bailey & Company, Boston, Mass., finished about 1,500 miles of steady plugging at Chicago, Ill., on the evening of Friday, October 31. The run was made to prove the availability of the electric automobile equipped with an Edison battery to do service in actual touring. Just previous to this run Colonel Bailey had made a 566-mile tour from Boston to Burlington, Vt., and returned through New Hampshire. The car was No. 1313, model "F" roadster, equipped with a General Electric motor and 60 cells of A-6 Edison battery. The tires were the United States special electric. Colonel Bailey was accompanied by H. J. Foote, electrical engineer of the company, as a traveling companion.

The first stage of the tour began on Tuesday, October 14, covering from Boston to New York City, through Worcester, Springfield and New Haven. The total distance, 239 miles, was covered in eleven hours and eight minutes running time, absorbing all road stops. This was an average of 21.5 miles per hour. The run to Springfield was against a strong head wind, that to New Haven, 66 miles, was made at 23.5 miles per hour; a stop over night was made here by request, and the run into New York the next afternoon, 78 miles, was on one charge at a little better than 20 miles per hour.

Several days were spent in New York City at the Electric Show. The next part of the run began Sunday, October 19. At this point the weather conditions changed remarkably. Fine weather was followed by ten days of the heaviest rainfall of the entire year. In spite of the wet heavy roads, the first day's run to Albany, 150.3 miles, was made in two runs with a rather long boost at Poughkeepsie. The car was on charge that night in Albany, or rather it was put in a garage with the intention of having it charged, but on the next morning, Monday, October 30, on arriving at the garage, Colonel Bailey found that nothing had been done. The car was transferred to the electric light company's plant but as it was impossible to obtain a high rate of charge practically a day was lost, only 18 miles being covered to Schenectady.

On Tuesday the trip was continued up the Mohawk Valley, against a strong head wind with frequent heavy rain squalls, to Utica, 79.8 miles, in four hours and fifty-one minutes. This included going through four miles of open highway construction. The run of 50 miles to Syracuse was made after a boost at Utica, making a total for the day of 129.8 miles.

On Wednesday the weather was fair during the day, fine roads. A stop was made at Geneva for a boost, and the run to Rochester, 86 miles, was made in two hours. After another partial charge in Rochester, the run of 77 miles to Buffalo, was made after dark in a light rain. Total run for this day, 173.5 miles, at an average speed of 21 miles per hour.

At Buffalo, a half-day stop was made on account of special business. The run continued in the afternoon. From ten miles out of Buffalo, the road conditions changed entirely. From here to near Painesville, O., there are no macadamized roads, very little of even gravel roads, and while they are reported to be quite passable in dry weather, they were certainly atrocious under the influence of the week's rain. Nevertheless, on Thursday a distance of 104.3 miles was made to Erie, Pa., with a boost midway at Dunkirk, N. Y.

Friday morning opened, raining harder than ever. The start was late on account of somewhat weak charging facilities, and the roads worse than any yet encountered. Several deep river bottoms had to be passed by means of steep descents and assents through the clay banks. Ashtabula, 45 miles out, was reached too late to get a full charge required, though most generous service was rendered by the local service-station manager.

The charge had to be continued the next morning, and the run was made into Cleveland during the afternoon, 59.6 miles.

In Cleveland a stop was made over Sunday for rest and to acquire road information. This was not encouraging as Colonel Bailey was informed of one stretch in which a good gas car has only been able to make 40 miles in nine hours; nevertheless, a run of 61 miles to Norwalk, O., was made over this route, and after a boost a short evening run was made to Fremont, O., still in the rain. 85 miles for this day.

On Tuesday, a run of some 33 miles was made to Toledo over good but quite worn macadam road. A fairly good charge was taken here during the day, and the run continued west. Some ten miles from Toledo the macadam road ended, and the clay and sand road continued to the Indiana line. The night was spent at Wauseon, and a boost taken at Archbold, and the run was continued to Kendallville, Ind., some 85 miles. The roads became better in Indiana, though heavy from rain, and here Col. Bailey joyfully telegraphed that the worst was over, but was doomed to disappointment. The run was continued Thursday morning in a lively snow storm, which turned to rain, and though South Bend was reached quite early, it was too late to charge and go through.

Friday there was encountered between South Bend and LaPorte nearly the heaviest road of the run, so a "boost" was taken here, and the run to Chicago was then made over a good road, 102 miles for the day.

The trip was completed with no accident to the car nor failure of any part. While some of the day's runs were short, and the speed slow, they were as far and as fast as other cars. The car was mired some four times during the trip, but came out under its own power in each case but once. Many gasoline cars were passed on the road, very few indeed passed the electric. Colonel Bailey reports that had the weather conditions been fair, the ride would have been a pleasure and the run could easily have been made at an average of about 150 miles per day at good motoring speeds. The average to Cleveland was better than 18 miles per hour as it was.

Colonel Bailey was tendered a luncheon at the Chicago Athletic Association by the Chicago Section of the Electric Vehicle Association, on Saturday, November 1. After luncheon those present participated in a delightful discussion, bringing out the fact that in good weather the trip would not have been any stunt at all; that everywhere along the line central-station managers were disposed to go to extraordinary trouble to provide adequate facilities, and that the disposition appeared to be one of great interest and helpfulness, and in practically every instance where the proper facilities were not now available, assurance was given Colonel Bailey that the right facilities would be procured forthwith.

Pittsburgh Section Dinner.

At the monthly dinner of Duquesne Light Company Section of the National Electric Light Association, held in the Colonial-Annex Hotel, Pittsburgh, Pa., on October 23, the moving-picture exhibition of the Pittsburgh Industrial Development Commission was shown. This exhibit is a series of lantern slides and motion pictures depicting Progressive Pittsburgh. The lecturer told of the many ways in which Pittsburgh leads all other cities.

Electricity in Cotton-Seed Oil Mills.

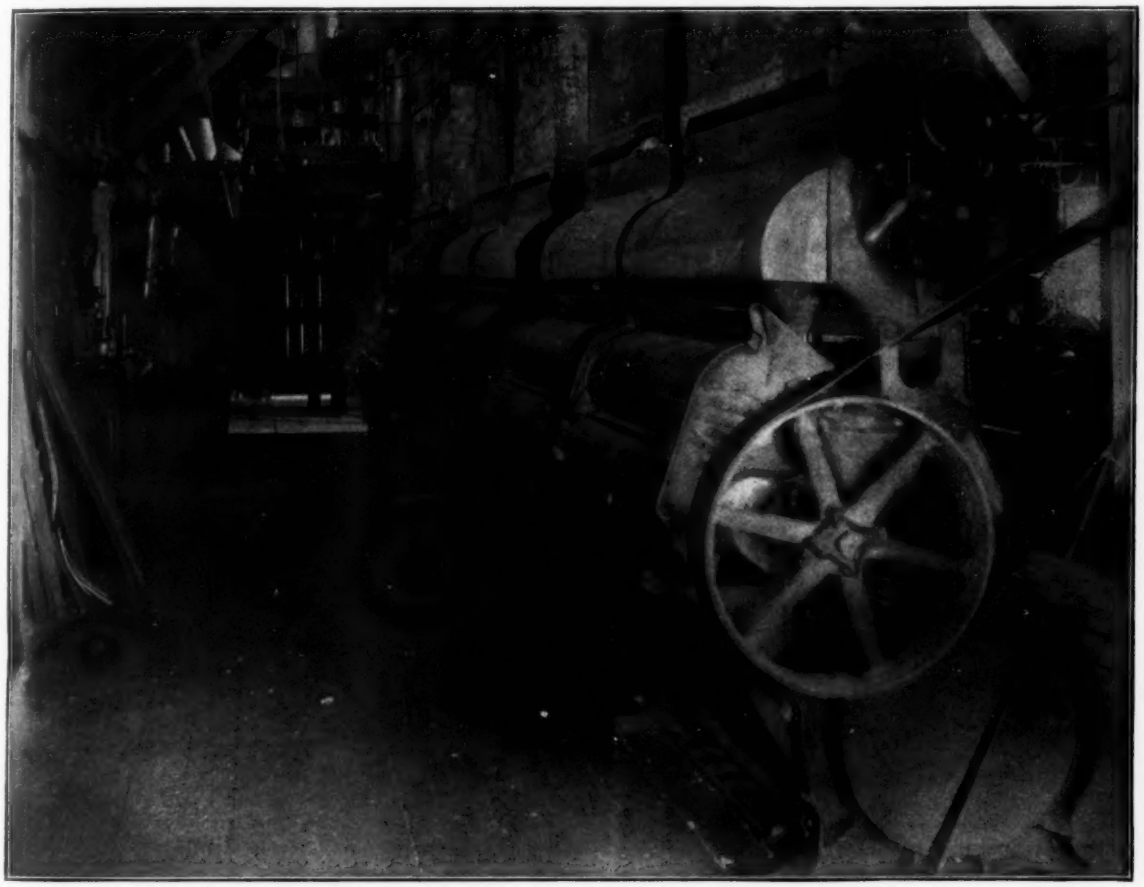
By W. L. Southwell.

In 1911 there were 841 oil mills in operation in twelve Southern States. These mills crushed approximately 4,921,000 tons of seed for which they paid $131,340,000 to Southern farmers. The commercial value of the output of these mills was about $323,000,000.

To drive these 841 mills at least 200,000 horsepower is required, offering a very large and desirable market for central-station power.

The cotton goes direct from the field to the ginnery where the fiber is separated from the seed. The seed is then delivered to the oil mills where the oil is extracted and the several by-products properly separated.

Owing to the high operating load-factor of cotton-seed oil mills this business is most desirable from the central-station standpoint, and although steam is required for cooking, operating economies can be effected by purchased power. Test data on a typical mill are presented in this article.



Group of Cotton Gins Driven by 75-Horsepower Motor.

In general one ton of cotton seed will produce:

350 pounds of oil
951 pounds of cake
49 pounds of linters
650 pounds of hulls

Ample market has been developed for all the above products so that nothing is wasted. The oil is used in producing various vegetable cooking compounds, soaps, candles, and for many other purposes. The hulls are used extensively in commercial cattle feeds. The lint is used as filling for mattresses, bedding, etc. The cotton-seed meal is used for stock feed and in the manufacture of commercial fertilizer.

The oil mill operating season is short, usually lasting about eight months—from about September 1 to May 1, but the operating load-factor is very high, due to the continuous 24-hour operation of the mill throughout the entire season.

About 75 per cent of the total power requirements is used continuously 24 hours per day from Monday morning till Saturday night, when the mill is usually shut down for the Sunday holiday. The cake-grinding department, representing about 25 per cent of the total power load, generally operates from ten to twelve hours per day, and, when desirable, arrangements can usually be made whereby this department of the mill is not operated during the time of the central-station's peak load.

In the typical oil mill, the sequence of operations is about as follows: The cotton seed is unloaded from the wagon or cars into the seed house from which point it is transmitted by means of bucket elevators and screw conveyors to the seed cleaners and linters, which remove all

foreign matter and the short lint which the ginnery failed to remove.

The cleaned seed from the linters is then taken by conveyors to the hullers which separate the kernel, or meat, from the hulls. Auxiliary to the hullers are the revolving screens and shakers which complete this process of operation.

The hulls are now conveyed to the hull storage house to be sacked for shipment. The meats are conveyed to the crushing rolls and then to the cookers.

From the cookers the meats pass to the oil presses which extract the oil, leaving the "cake," which after drying is broken up by the cake breaker and then pulverized in the cake mill.

The oil-mill load is very steady as the various operations form a continuous process, and practically all the machinery is in full operation all the time.

With few exceptions, the small and moderate sized oil mills are operated by simple non-condensing engines, and the efficiency, therefore, is not the best, though the continuous uniform load, allowing the engine to run continuously at approximately its rated capacity, contributes to a fair economy.

The fact that steam is required for cooking the meat has been the greatest obstacle to the electrification of oil mills.

Data secured from several steam driven mills indicate that from 400 to 600 pounds of coal are required for all purposes, including cooking, for each ton of seed crushed. 500 pounds of coal per ton of seed may be taken as an average figure.

Tests of several electrically driven mills indicate that for cooking alone, 60 to 90 pounds of coal are required for each ton of seed cooked. 75 pounds of coal per ton of seed may be considered a fair average. The best economy is, of course, obtained by the installation of a small boiler of just sufficient capacity to supply the steam required for the cookers, though many mills after electrification, continue to operate one of their large boilers for this purpose, at of course, a considerable sacrifice in economy.

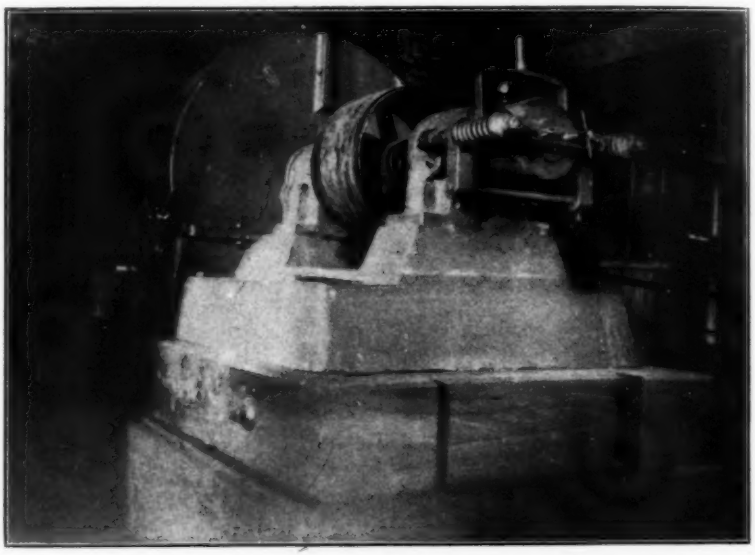
Electric drive offers many advantages in oil-mill operation. The convenience, cleanliness, and flexibility of motor drive appeal strongly to the progressive mill man, recognizing, as he does, that these and many other advantages possible only with electric power, possess a real money value, in contributing to the total plant efficiency.

Because of the uniform continuous operation of the oil-mill machinery, the fact that the various operations constitute a continuous process, and the location and nature of the various drives, individual motor drive has not been very extensively employed. Group drive for the various departments is usually used, the exact grouping of machinery depending, of course, upon local conditions.

In many small mills one large motor is quite frequently used to drive the entire plant with the exception of the cake department for which a separate motor is provided. In very few instances can any appreciable amount of friction load be eliminated in the small mills by a division of the machinery into smaller groups, so that the large group drive is usually preferable, both in respect to first cost and operating efficiency.

In a few of the large mills greater refinements in motor application have been very successfully made. One very satisfactory installation is described below.

This mill has a rated capacity of 40 tons of seed per 24 hours. During the season of 1911-1912 approximately 7,000 tons of seed were crushed.



Two 50-Horsepower Motors Driving No. 19 Foos Attrition Mill.

The motor equipment in this plant was specified with considerable care and the motors are in every instance of correct capacity for the service required.

Electric power is purchased at three-phase, 6,600 volts from the Central Georgia Power Company. A small brick substation was erected by the mill and contains three 100-kilovolt-ampere transformers to reduce the line voltage to 550 volts.

In addition to the transformers, the substation contains a three-panel switchboard, lightning arrestor, choke coils, and other incidental equipment. The motor equipment is as follows.

One 75-horsepower slip-ring type motor operating at 720 revolutions per minute, belted to the main line shaft from which the following machines are driven: two 30-inch Foos hullers; two shakers; two screens; one cotton press; five linters; 200 feet of 9-inch and 12-inch screw conveyors; and 100 feet of bucket elevators.

One 35-horsepower squirrel-cage motor running at 900 revolutions per minute, belted to a 30-foot line shaft from which five Carver linters are driven.

One 35-horsepower squirrel-cage motor running at 900 revolutions per minute, belted to line shaft from which the following machines are driven: five 48-inch rolls; three cookers; one small oil pump; two 25-foot bucket elevators; and 125 feet of 9-inch screw conveyor.

One 15-horsepower squirrel-cage motor running at 1,200 revolutions per minute, belted to accumulator pumps.

Two 20-horsepower squirrel-cage motors running at 1,200 revolutions per minute, each belted to one side of a 26-inch American attrition mill.

One 20-horsepower squirrel-cage motor running at 1,200 revolutions per minute, belted to one No. 5 Foos cake breaker; 40 feet of 9-inch screw conveyor and one 25-foot elevator.

One 20-horsepower squirrel-cage motor running at 1,200 revolutions per minute, driving 450 feet of 9-inch and 12-inch screw conveyor; and two 40-foot bucket elevators in seed house.

One 15-horsepower squirrel-cage motor running at 1,200 revolutions per minute, driving 100 feet of 9-inch conveyor; two 30-foot elevators and two sackers.

In connection with this mill a four-stand 280-saw gin is operated by the following motors: One 50-horsepower squirrel-cage motor, 900 revolutions per minute, driving the gin, and one 20-horsepower squirrel-cage motor, 1,800 revolutions per minute, directly connected to a No. 32 Sturtevant 42-inch exhaust fan for unloading cotton.

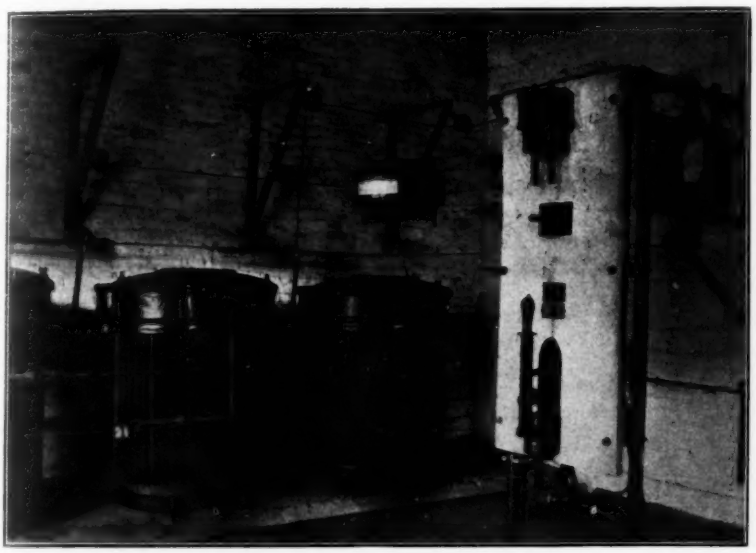
All motors are three-phase, 550 volts, 60 cycles, and are equipped with dust-proof bearings, automatic overload and no-voltage protection.

This oil mill began electric operation in October, 1911. Several tests made at the mill indicate that the maximum demand with all machinery running (not including the ginnery) averages about 236 horsepower.

The current consumption, including the ginnery, is shown herewith.

January	79,100
February	71,900
March	73,100
April	69,100
May	57,200
June	29,700
July	100
August	500
September	27,900
October	93,500
November	84,300
December	63,000

The ginning season usually lasts from three to four months, beginning in September and ending in December or January.



6,600-Volt Transformer Station Serving Oil Mill.

Record of results obtanied in several successfully electrified oil mills indicates a current consumption per ton of seed crushed ranging from 50 to 75 kilowatt-hours. Under average conditions it is safe to estimate 60 kilowatt-hours per ton of seed.

For ginning, about 18 kilowatt-hours are required per bale of cotton ginned, though results as low as 15 kilowatt-hours per bale have been obtained.

An exhaustive test recently made in a large electrically driven oil mill presents some interesting data and is given in detail herewith.

Seed House.

The equipment consists of 180 feet of 12-inch screw conveyor running at a speed of 165 revolutions per minute carrying seed at a rate of 20 tons per hour; and 40-foot elevators operating at a speed of 550 revolutions per minute. This equipment is driven by a 15-horsepower squirrel-cage motor operating at a full-load speed of 1,120 revolutions.

Conditions During Test	Horsepower Input to Motor
1. Motor idle	2.01
2. Motor and shafting idle	3.35
3. Conveyors running empty	8.5
4. Elevators running empty	10.25
5. Conveyors loaded	14.75
6. Elevator loaded	18.75

Huller Test.

The equipment consists of two 30-inch Eclipse hullers, hulling 70 tons of seed in 24 hours, driven by a 40-horsepower squirrel-cage motor running at 900 revolutions per minute.

Conditions During Test	Horsepower Input to Motor
1. Motor idle	2.
2. 2.875-inch shaft, 24-feet long; 120 feet of 12-inch conveyor empty; and two hullers empty	19.25
3. Two hullers loaded	41.
4. Power for 120 feet of 12-inch conveyor	1.5

Cake Mill.

The cake mill is a No. 19 36-inch Foos mill driven by two 50-horsepower motors, one motor belted to each side of the mill. Three tests were made under different conditions.

Test No. 1.

Regrinding black-seed meal at a rate of 3.75 tons per hour.

Conditions During Test	Horsepower Input to Motors
Mill empty	26.8
Mill loaded	120-146

Test No. 2.

Grinding dry or cold cake at the rate of 9.75 tons per hour.

Mill loaded ..... 112 horsepower

Test No. 3.

Grinding wet or hot cake at the rate of 11.25 tons per hour.

Mill loaded ..... 130 horsepower

Linter Test.

The equipment consists of seven Carver linters driven from 2.75-inch line shaft 90 feet long by a 50-horsepower motor running at 900 revolutions per minute. The linters were operated at 346 revolutions per minute.

Conditions During Test	Horsepower Input to Motor
Main line shaft and floats	8.0
Seven linters, empty	20.4
Seven linters, loaded	55.0

Advantages of Motor Drive.

In an oil mill, as in a cotton gin, practically all operations are conducted in unison. Each machine is dependent upon a preceding machine for its operation, no storage facilities being provided at any stage. The production of a mill is therefore dependent, in a large measure, upon how well the operations are balanced so that each machine will operate at its maximum efficiency. Also, as steam is required for cooking purposes it is easy to see why mill operators have had a tendency to adhere to the central steam-engine drive.

Under the conditions which obtained in former years, when the cotton-seed hulls were used for fuel, the steam-engine drive, even considering the excessive friction losses, may not have admitted of central-station competition. Today, however, hulls are sold at an attractive figure and coal is used for fuel. Under these conditions, confining a comparison to actual operating costs, it would not be unusual to find a saving in purchasing power. It is not the purpose of this article to discuss relative costs of steam operated versus central-station power operated mills as no reliable data are available. In this particular industry actual operating costs are of secondary importance to the advantages accruing from the use of electric motors, purchasing power from a central station.

The advantages of electric drive in oil mills are certainly most pronounced.

First in point of importance is the marked reduction in fire risk. It will readily be seen that the danger from fire is marked due to the excessive amount of inflammable lint and dust connected with the various linting and cleaning operations. If power is obtained from an adjacent steam plant the fire risk is great and insurance rates correspondingly high. Mechanical drive necessitates either the dangerous proximity of the boiler room or heavy losses in long steam mains or rope transmission. If central-station power is used all danger from adjoining power plant is removed. The elimination of heavy line shafts also greatly reduces the danger of fire from overheated journal boxes and from spontaneous combustion.

Other advantages of central-station service, such as reliability, availability any moment day or night, decreased investment in plant, freedom from annoyance and expense which must accompany the operation of an isolated plant, freedom from hazard of boiler explosions, etc., are of even greater importance in oil mills than in the majority of industries. Also, electric drive minimizes the danger of accidents and delays, the latter being especially important in this field.

Commercial Practice
Management, Rates, New Business

House Wiring Campaign at Toledo.

The Toledo Railways & Light Company is conducting an active campaign in house wiring which is resulting in the wiring of from 12 to 15 new houses per day, according to Mr. Kelsey, advertising manager. He states, "We have been conducting this campaign for a couple of weeks only and have already 150 new houses on our list. The campaign will continue for another month." Mr. Kelsey also announced the opening of a campaign for electric appliances, including a suction cleaner. Coupons were recently sent out to the 20,000 customers of the company with the regular monthly statements, which entitles the possessor to a $50 outfit on the payment of $40 which can be paid in cash or at the rate of $5 down and $5 a month.

Two New Booklets of the New York Edison Company.

Two noteworthy booklets have recently been issued by the New York Edison Company, under the auspices of the Educational Bureau, which are doing much towards popularizing electricity in the home in the metropolis. "Electricity A to Z" is the title of one which is designed particularly for children and which follows closely the style of the usual nursery rhymes. Each letter in the alphabet is taken as the basis for a short verse relative to some domestic electrical device and a suitable illustration, appealing to the young ones, accompanies every rhyme.

"Electricity in the Home" is the title of the second booklet, which, in the words of the author, "is published for use by housewives. Its purpose is to define the common electrical terms used by representatives of the company and heard on every hand but not always fully understood. It aims to give an idea of the many uses to which electricity can be applied in the home, and to answer the every-day questions which so often come into a person's mind but go unanswered because you lack time to appeal to the proper source of information." In addition to information relative to various electrical appliances, etc., the booklet contains a number of receipts of dainty dishes for chafing-dish luncheons.

Both booklets are interesting to all users of central-station service and in appearance leave nothing to be desired.

Service Code of a Successful Central-Station Company.

The Union Electric Light & Power Company, of St. Louis, Mo., has recently issued a little booklet entitled, "Service Code," intended for employees of the company, which contains so many admirable provisions applicable to all central stations that it is reproduced in full herewith. It is needless to say that should all the provisions of this code be carried out the St. Louis company, or in fact any company, cannot but win and hold the confidence and esteem of the public it serves.

Our company is operated to sell to the citizens of St. Louis electricity, and incidentally such other service and equipment or appliances as will make electricity available.

Without consumers there would be no Union Electric Light & Power Company.

These are simple facts easily understood. It therefore behooves every man and woman in our employ to remember this always, and to see that every customer is treated with courtesy and proper consideration.

Any member of the force who lacks the intelligence to interpret the feeling of good will and fair treatment the Union Electric Light & Power Company holds towards its customers can not stay very long with us.

New customers are just as valuable to us as old customers—remember that; for each new customer is an old customer in the making.

See that you do your part to make the customer feel that everybody's business is appreciated.

Impress upon him the fine good-fellowship in our company, the no-trouble-to-show-you spirit.

When a customer walks in, meet him half way, by showing an interest in what he wants or in any information he may be seeking.

You must take the customer and handle him according to conditions and the particular mood in which you find him.

The stranger in antiquated raiment may be one of the best customers on our books.

Always remember the customer pays your salary. He is your immediate benefactor.

We are just as anxious to have the business from the North side and South side as we are from the West end.

Have every one feel that we want to give him better value and better service than ever before received.

The employee who helps to perpetuate this plan is never out of a job, nor does he escape the eyes of the Man Behind the Scenes—The Boss.

At rare intervals some perverse member of our force disagrees with some customer as to the rightness of this or that.

He maintains that he had no instructions to make a quick connection when the customer says he did.

Or that the order was for 60-watt lamps instead of 40.

Or that it was a 16-inch fan and not 12-inch.

Or that this was ordered and not that. Either may be right.

These are permanent instructions. No employee of the Union Electric Light & Power Company is allowed the privilege of arguing the point with the customer.

He must adjust the matter at once in a pleasant and satisfactory manner to the customer, or call his superior to adjust it. Wrangling should have no place in the Union Electric Light & Power Company.

Our business is successful and there is good reason for it.

The reason is that we give good service at reasonable prices and with the right kind of people to handle the business.

Everyone from the errand boy up to the boss is working all the time to give the customer the service he wants.

Ike Milliken says, "Most of the big men got the big jobs by making the little jobs bigger."

The company has incorporated in its trade-mark the word "Service."

Upon this word "Service" rests the reputation of the company.

The word "Service" in our trademark is intended to convey to the public that for which our company stands.

Back of this word "Service" is a waterpower plant of 120,000 horsepower, and a central steam generating station of 100,000 horsepower capacity, with a record of twenty-four hours a day for seven years without five minutes' loss of time.

An underground and overhead distributing system second to none. A highly efficient and well-trained corps of trouble men with a fleet of automobiles on duty day and night.

An organization of officials, salesmen and clerks trained to the highest degree of efficiency.

We have a reputation for rendering service which the head of every department is instructed to maintain.

This reputation has cost us and the men before our time untold labor in building it up to this perfection.

Filling orders as given and making deliveries as promised is Good Service.

The service of a company like ours is not a thing supplied by any single individual. It is not special attention to any one customer.

Service means the limit of courteous, efficient attention from each particular employee to each particular customer or order.

It rests with every employee of this company (errand boy, order clerk, salesman, telephone operator, cashier, manager) whether the customer goes away disappointed or pleased.

The clerk can wait on a customer in a "What-do-you-want" manner that will stick in the customer's "crop," and make him feel that there is something radically wrong with the business and make him regret he came in.

Or he can wait on the customer in such a manner that he will go out of his way to do business with us.

If the customer asks for a quick connection, don't get rid of the matter by answering, "It will be made right away," without knowing or getting information from the operating department if it is possible to accommodate the customer.

Sometimes it is impossible to make delivery that the customer wants, and sometimes no trouble at all when you explain the importance of the delivery to the proper department.

For it would be better to lose the order than to have a disappointed customer on account of not being able to carry out your promise.

An operator or clerk who is quick to answer telephone calls and does not keep a customer holding a cold receiver to his ear listening intently to nothing, can swell the appreciation of our Service and swell our appreciation of him or herself.

Electric-Vehicle Operating Data.

The accompanying table which was incorporated in a committee report presented before the recent convention of the Electric Vehicle Association of America, gives general average operating costs of electric vehicles, based upon all authentic available figures published in this connection heretofore.

GENERAL AVERAGE OPERATING COSTS OF ELECTRIC VEHICLES.
Based Upon Figures Which are as Nearly Representative as the Varying Equipments on the Market at Present.

Capacity	700 lb.	1,000 lb.	2,000 lb.	3,000 lb.	4,000 lb.	7,000 lb.	10,000 lb.
Approximate price	$1,500	$2,200	$2,600	$3,000	$3,400	$4,000	$4,500
Fixed Charges							
Interest @ 6%	$90	$132	$156	$180	$204	$240	$270
Depreciation @ 10%	150	220	260	300	340	400	450
Fire insurance @ 1%	15	22	26	30	34	40	45
Liability insurance	100	100	100	100	100	100	100
	$355	$474	$542	$610	$678	$780	$865
Maintenance							
Battery upkeep	$170	$180	$200	$240	$285	$365	$415
Tire upkeep	130	150	180	230	280	400	600
Mech. parts upkeep	50	60	80	90	100	125	150
	350	390	460	560	665	890	1,165
Garaging							
Electric power	$120	$140	$170	$240	$300	$360	$400
Storage and washing	180	180	180	180	180	180	180
Garage labor	100	120	160	180	200	250	300
	400	440	510	600	680	790	880
Annual operating cost	$1,105	$1,304	$1,512	$1,770	$2,023	$2,460	$2,910
Daily cost (312 days)	$3.54	$4.18	$4.84	$5.67	$6.48	$7.88	$9.32
Drivers per day	2.00	2.00	2.50	2.50	2.50	3.00	3.00
Total daily cost	$5.54	$6.18	$7.34	$8.17	$8.98	$10.88	$12.32

Edison Battery Equipment will have lower maintenance and higher power consumption than above.
Depreciation @ 10% should provide one complete equipment renewal in ten years, which is not figured in maintenance as above.
Interest should strictly be at 3% as depreciation fund gradually reduces investment.

It is interesting to note that the cost of current is only slightly above 10 per cent of the total operating cost of each size vehicle. The mileage in each case is taken as the rated capacity of the type batteries commonly installed on vehicles of the respective sizes covered by the table.

Data such as these must necessarily be a compromise between actual cost data on vehicles in various classes of service but for arriving at approximate estimates the table should be of exceptional value to central-station and electric-vehicle salesmen.

Rates Lowered at New Castle.

The New Castle Electric Company, operating at New Castle, Pa., has made a reduction in rates, effective November 1. The new primary and secondary rates are nine and five cents per kilowatt-hour respectively, from which a reduction of 10 per cent is made for prompt payment.

Data on Electric Welding.

Some interesting data on electric welding, as applied to railway shops, were presented recently before the Association of Railway Electrical Engineers by George W. Cravens, as chairman of the shop-practice committee. There are several processes by which electricity is used for joining metals: Spot welding, or joining comparatively thin sheet metal by heating in spots and applying pressure; butt welding, or the joining of moderately large sections end to end by a similar process; and arc welding, or the joining, filling up holes, or building up parts, or entire pieces, of metal through melting additional metal into place with the electric arc as a flame.

Spot welding has found but limited use, thus far, in railroad shops; butt welding has been used somewhat more for making rings, tires, long bars, tubes, etc., and arc welding is being used by a large number of shops for the above purposes in addition to repairing cracks in sheets and castings, filling in bad spots, welding in boiler tubes, building up broken lugs, etc. It is this use of electric welding that the committee report discusses.

The electric arc is used in railroad shops for welding by two processes, one being known as the Bernardos and the other as the Slavianoff process, being named after the men who have done most to perfect them. The Bernardos process consists in drawing the arc between the piece worked upon and an electrode of carbon or graphite, using the arc the same as a gas flame for melting proper filling materials into place. This process is gradually being called simply "graphite welding," and is suitable for all of the heavier kinds of welding, the arc also being used for cutting as with acetylene. The Slavianoff process consists in using the work as one terminal for the arc, in a similar way to the other, but using a piece of the filling material as the other electrode and melting it into place direct. The metallic electrode is usually in the form of a piece of wire of the proper composition, and is held in a suitable holder somewhat smaller than for the graphite electrode. This process is becoming known as "metallic welding" and is especially suitable for light work, boiler tubes, sheet metal, etc.

With both of these processes the work is made the positive terminal of the arc and the electrode the negative, because the positive crater of an arc is always the hotter and this insures the work being warm enough to prevent chilling of the filling material. This is one reason electric welding is gradually superseding acetylene welding in so

many railroad shops. By proper selection of the filling material the weld may be made of the same hardness and composition as the part worked upon, and full strength may be obtained in most cases by proper manipulation while welding.

Owing to the very sensitive nature of the electric arc it is of great importance that the source of current supply be controlled as positively as possible, and experience shows that a motor-generator set is the best means of getting good regulation of the supply. This also provides a satisfactory means of operating from alternating-current feeders, because a direct or continuous current is required and rotary converters provide very poor voltage regulation. They have been tried with but indifferent success, so about 90 per cent of the electric arc-welding machines in use today are motor-generator sets.

The use of resistances in the form of groups of iron grids or water barrels has been tried in some shops, but this is very wasteful because the best voltage for arc welding is around 70 to 75 volts. Experience also shows that unless some means is provided for the independent control of each welding circuit it is not practicable to attempt to operate more than one circuit from a single source. This has made those systems using automatic control the most satisfactory, and a large number of railroad shops have adopted them.

With the Bernardos system, using a carbon or graphite electrode, the current required will range from 100 to 800 amperes per circuit on the welding or low-voltage side, the line current depending upon the efficiency of the apparatus and the line voltage. With the Slavianoff system, using metallic electrodes, the current will vary from 20 to 200 amperes, depending upon the nature of the work, the size of the piece being manipulated and the material. The usual operations with the metallic electrode, however, require but from 40 to 100 amperes, and with the graphite electrode from 300 to 500 amperes, the latter being frequently used for cutting purposes.

Electric arc welding is being used in railroad shops today for repairing iron, steel, copper and aluminum castings, forgings, tubes and sheets; forged-steel locomotive frames, axles, tires, side rods and valve gear; cracks in fire boxes, flue sheets, cylinders, wheels, journal boxes, tender and truck frames; welding in flues, side seams, mud rings, fire-door frames, attaching heads, heating rivets and stay bolts, cutting holes in boiler sheets, cutting and joining bars in forge shops; building car frames, putting on the sides and roofs, making one-piece roofs, attaching interior and exterior trim, making up complicated sections of piping, truck bolsters, and the hundreds of other operations involved in the joining and repairing of metals. In foundries the carbon arc is used for cutting off risers, gates, fins, and filling in sink heads, sand holes, cold shuts, missing parts, and welding shrinkage cracks, thus reclaiming a large amount of spoiled work and saving valuable time as well as money.

The cost of welding with the electric arc is lower than by any other method, usually being about one-third that of the gas systems and the time required being about one-half for similar jobs. This applies to the oxy-acetylene, oxy-hydrogen and blau-gas processes and is due to the higher cost of the gases as well as their lower temperature, and the difference in favor of the electric system is still greater when compared with Thermit welding.

Through the courtesy of the C. & C. Electric & Manufacturing Company of Garwood, N. J., the committee presented the following figures showing the cost of electric arc welding as actually done in several railroad shops.

Time and Costs of Various Repairs.

Steel casting, crack 6-in. long by 1-in. deep	8 min.	$0.04
Steel casting, riser 4-in. by 4-in. cut off	4 min.	0.05
Forged steel locomotive frame, 2 breaks	20 hrs.	18.28
Crack 12-in. long in boiler back sheet	9 hrs.	5.47
Cast-steel tender frame, 3 breaks	27 hrs.	19.00
Broken railway-type motor case, cast steel	3 hrs.	1.95
Enlarged holes in brake levers, steel bars	4 min.	0.05
Air-brake piston rods, broken	30 min.	0.35
Cracked axle boxes, welded in place	15 min.	0.15

Savings by Repairs Instead of Replacements.

Armature shaft repaired in place, worn journals	$13.16
Railway motor axle cap, large, cracked	3.29
Railway motor armature bearing cap, broken	5.80
Railway motor gear case, top half broken	6.82
Truck side frame, broken	43.68
Truck side frame, broken	46.08
Motor frame, railway type, cracked	13.92

Saving by Electric Arc Welding Instead of Old Method.

Engine main frames, both broken	$ 44.40
Driving wheel built up on tread 3/16-in.	7.28
General repairs on fire box side sheets	276.11
Filling in worn knuckle joint bushing hole	6.75
Locomotive cylinder casting, 7 cracks	344.50
Broken mud ring on locomotive boiler	85.99

Electric Vehicles for Night Trucking.

In the presidential address delivered before the recent convention of the Electric Vehicle Association of America, Arthur Williams, of New York, made a suggestion relative to relieving traffic congestion that is of particular significance. He said that the secret of relieving congestion in the business sections of our cities is not to be found in the construction of elevated or underground streets, but rather in the substitution of night for day trucking. This would apply to wholesale trucking from terminals to warehouses; to all trucking in large bulk to our great department stores; to the delivery of coal to our large buildings, etc.

The economic advantages to the community will be enormous. Thus the use of the investment in terminals and warehouse plants will be extended over a wider period of the day; the investment in payments in our larger cities will be given a more extended and, therefore, a better average use. Wear and tear and, therefore, general depreciation upon the transporting vehicles will be greatly lessened through the holding of a straighter course and less frequent stops, many of them made suddenly to avoid collision or injury to pedestrians.

There is nothing in the electric truck which limits its use in the matter of hours. As in many other departments of human activity, employees will quickly become accustomed to the change in hours, and, because of lessened mental concentration and physical effort, they will accomplish the same amount of work with far less fatigue. In the heat of summer both machine and man will work better at night and at least the human interests are conserved in winter by the lessened time during which for a given amount of transportation the driver will be exposed to the elements.

Irrigation by Electric Power Near Stockton, Cal.

The Western States Gas & Electric Company, a Byllesby property, first made efforts to develop the use of electric power for irrigation purposes in the territory north of Stockton, Cal., in February, 1912. In October, 1913, the company had connected 4,652 horsepower in motors, all used for pumping water in the irrigated districts, the water being obtained from 30 to 50-foot wells. By irrigating already fertile San Joaquin lands in this way, their productiveness is greatly increased. Samuel Kahn, general manager of the Stockton property says: "We receive daily applications for electric power in the rural districts which come totally unsolicited, for every farmer who has power on his ranch acts as a new-business agent for our company. The real-estate companies which are subdividing tracts of land act as power salesmen for us also. I have in mind a firm which at the present time is selling off 5 and 10-acre ranches and with each ranch they give the purchaser a motor and a pump and at the same time have him sign an application for power."

Electrical Construction

SOME PRINTED FORMS FOR THE ELECTRICAL CONTRACTOR.

By E. M. Raetz.

While it is more frequently the case that the contractor's system of keeping data on costs and materials is inadequate, it may happen that his system is more elaborate and complex than is at all necessary. The practice of some small electrical contractors in this respect reminds one of buying a thousand-dollar horse to be used in drawing a ten-dollar carriage.

The company which the writer manages aims always to keep its methods of accounting and cost-keeping up-to-date, but, at the same time, it tries to avoid unnecessary expensiveness and complexity. The printed forms shown in the accompanying figures are typical of the forms used by us.

Fig. 1 is the blank we use for memoranda of work to be installed in residences and the like. In our town it is the custom, when a new house is to be wired, to conclude the first part of the job with the installation of the wires, the setting of the switchboxes, etc.; and then setting the switches, installing the cutouts, hanging the fixtures, etc., is done in another job, at a later time. Very often the builder has the wiring, while the owner will buy the fixtures. The writer has found that in making hurried estimates preliminary to submitting bids on jobs of this sort, the contractor is liable to overlook important items. Or it may happen that the owner will forget, after the contract has been awarded, just what the contractor really bound himself to put in. Contention and dissatisfaction result. Proper use of the simple form shown in Fig. 1 avoids such contingencies as these. This form is printed in duplicate, white paper being used for the original and yellow for the duplicate. A complete enumeration of all the things the contractor is expected to install is written on the white sheet, and the yellow, carbon copy is given to the owner when the bid is submitted.

E. M. RAETZ & CO. "THE ELECTRIC SHOP"

For ..... At ..... Date ..... 191...

Porch .....
Hall .....
Living Room .....
Dining Room .....
Bed Room .....
Kitchen .....
Pantry .....
Basement .....
2nd. Hall .....
Bath .....
Bed Rooms .....
Attic .....
Snap Switches .....
Flush Switches .....
Cutouts and Fuses .....
Door Bell, complete wiring only .....
Line to pole, wire ..... Blks. ..... Ins.
Lamps .....
Total .....

E. M. RAETZ & CO. (by) .....

Fig. 1.—Form Employed for Making Memorandum of Work to be Installed.

Article	Description	Purchased From	Date of Invoice	Quantity	Unit Price
Knobs	Porcelain - No 5½ solid	Electric E Co	5-30-13	5,000	.006

Fig. 2.—Specimen of Card Used in Card File of Materials Purchased.

An incident that occurred before we began the use of this sheet which was typical is recalled. In figuring a job of wiring for a tailor we did not include the lamps. Then when we presented our bill with the lamps charged as an extra, he declared that it was like buying a coat without buttons and we had trouble in getting our money. Things of this kind never happen now.

We make use of a card file for cost and purchase records. Our cards are 5 by 8 inches; one of them is shown in Fig. 2. By making the proper entries on these when an invoice comes in with a shipment of goods we obtain a memorandum of unit prices on what we are buying that we find most helpful.

With our system of records we can always tell in a few moments, at any stage in a job that we are doing, just what the work has cost us in labor and materials. We think that our system is quite complete.

The output of coal for 1912 in Tennessee amounted to 6,473,228 tons, valued at $7,379,903.

Wiring for Electric Light and Power in Railway Buildings.

There appeared in these columns a year ago (see issue of November 2, 1912) a report of the Committee on Wiring for Electric Light and Power in Railway Buildings, of the Association of Railway Electrical Engineers. The following article is the substance of another report of the same committee, which was presented at the annual convention of the Association two weeks ago. While this report is rather largely concerned with the wiring of electrically operated bridges and accessory equipment, it contains many suggestions of interest and value to the man engaged in electrical construction of a general nature.

The report states that the first thing to be considered in furnishing electricity for a movable bridge is its availability. In some places it will be found that available current is too far from the bridge site and the expense very heavy to bring it to same. Under these circumstances the engineer must decide on the advisability of installing a local power plant: engine-driven generator and storage battery; bridge to be operated directly from storage battery and the storage battery charged from engine-driven dynamo.

There are in present use, three distinct types of movable bridges: The draw-bridge, which swings on its pivot pier; the bascule bridge or jack-knife bridge; and the vertical lift bridge. On all three types the bridge engineer usually furnishes the railroad company with the size of motor necessary to operate its particular structure. The part usually falling on the railroad company's electrical engineer, is the bringing of the current to the bridge. With the draw bridge it is usually brought to the nearest rest pier, and with the bascule bridge it is usually brought to the switchboard in the operator's house, while with the vertical lift bridge it may be brought to the base of the towers on either side of the river. From the switchboard on, including all equipment, the work is usually handled by the bridge company or electrical contractor.

Motors used on a bridge are usually of the railway or mill type; but this depends upon the kind of current available. The size of motor depends upon the weight of the structure, which is always specified by the bridge engineer. All motors are equipped with solenoid brakes.

The system of control of an electrically operated bridge is perhaps the most important feature of the entire installation. Direct operated drum controllers are desirable up to about 50 horsepower. Above 50 horsepower it becomes a question as to whether remote control should not be used; should the voltage be 220 or lower, remote control can be used efficiently. With remote control the contactors can be mounted close to the motor and the master drum located in the operator's house. On all small installations under 50 horsepower the street-car type of drum controller is preferable; that is, with a separate handle for reversing.

Cables and Wires.

In the draw type of bridge, it becomes necessary to transmit the current from the rest pier to the center pier by means of submarine cable. The moving of the bridge is dependent on this cable; consequently it cannot be too well made. A 30-per-cent para rubber insulation should be used, with a substantial wall of lead and galvanized-steel wire armor. The submarine cables should be substantially clamped to the piers, so there is little danger of their being injured from vessels moving in the channel.

All wire on a movable bridge should be of such a size that it will carry the current with no more than 5 per cent drop when motors are operating at full capacity, and on the lighting circuits not more than 3 per cent drop when lines are fully loaded. Due to the vibration and outdoor service, all wires should be insulated with 30 per cent pure para rubber, double-braided and of the thickness of insulation specified in the National Code for the respective sizes. No joints should be made in the pipe, and where joints are necessary, cast-iron junction boxes should be installed.

It is not desirable to ground on railroad bridges. All circuits should be of a complete metallic return to the switchboard.

Conduit and Fittings.

All conduit should be preferably of the galvanized make, and amply large, so that wires can be drawn in free from mechanical abrasion. All joints should be thoroughly leaded with white lead on making up the pipe. All fittings and junction boxes should be of cast iron, with plumbers' locknuts and rubber gaskets. All conduit should be drained at all low points of the line, so that any moisture collecting therein can be drained off.

Switchboards and Instruments.

A switchboard of sufficient size to carry all instruments necessary for the operation of the bridge is to be supplied. It is not desirable to use a current of over 550 volts alternating current on bridge work and not over 600 volts direct current. At these high voltages it is preferable to use marble instead of slate, unless slate can be procured which is absolutely free from metallic streaks. The switchboard should be located at a convenient point in the operator's house so that it can be in the direct view of the operator at all times during the operation of the bridge.

The instruments should be graduated with a scale sufficiently large to be easily read across the room. Recording ammeters or wattmeters are to be installed when an exact record of the number of openings of the span is desired. The charts from these instruments are authentic as to the number of operations. In the development of the art of electrical equipmen on bridges, it has been found that the solenoid contractor, with its overload coil, is preferable to the circuit-breaker, in that the operator does not have to leave his controller stand to reset a circuit-breaker. This is true for all motors used in the operation of a movable bridge.

Conduit.

All wrought-steel pipe or tubing must have the nominal diameter called for by the schedule, and must be what is known as full weight standard pipe. In each instance the inside diameter and thickness of wall are shown in Table 1.

TABLE I.

Nominal Diameter. Inches.	Actual Inside Diameter. Inches.	Thickness of Wall. Inches.
½	.62	.10
¾	.82	.11
1	.04	.13
1¼	1.38	.13
1½	1.61	.14
2	2.06	.15
2½	2.46	.20
3	3.06	.21

Conduits must have smooth interior surfaces, free from all seams and burs, and must be galvanized or sherardized.

All threads on conduits must be carefully cut, with the threads concentric with the bore and of sufficient length to accommodate all couplings, locknuts and bushings in connecting the conduits together or to the various cabinet, junction and outlet boxes.

All conduits must have the maker's name or trademark and the label of the Underwriters' Laboratories stamped upon each length.

Bends.

At all bends or changes in direction use elbows made of the same tubing as the conduit, curved to long radius, or bend the conduit itself to a long radius; in either case the bend shall be made in such a manner as not to flatten or in any way contract the bore of the conduit, nor injure the coating of it.

Joints.

The ends of all conduits and elbows shall be cut off true and square, and after being properly threaded shall be reamed so as to leave a smooth rounded or beveled edge at the junction of end face and bore of tube, all

joints to be made watertight, using standard galvanized or sherardized iron couplings with the ends of the conduits brought tight together. All joints in conduits that are to be laid in damp, moist or wet floors shall be made perfectly watertight with red or white lead.

No conduit containing any circuit or circuits shall have more than four bends between the panel-board box and the first outlet. In each case where more than four bends are required in any run of conduit a pull box shall be inserted for other bends.

Outlet and Junction Boxes.

For outlets in dry buildings where no watertight conduits system is required, pressed-steel boxes shall be used. These boxes shall be not less than No. 12 gauge material and must be thoroughly sherardized or galvanized. All outlet boxes must be provided with holes for supporting same; also holes for screws supporting fixture studs. In buildings subject to moisture of any description, only cast-iron outlet boxes shall be used. For outlets from ceiling, outlet boxes without threads can be used, but for wall outlets the boxes must have threaded connections and all joints must be made with either red or white lead. For switches, receptacles and plug outlets, the same class of construction will be required.

Conduits entering outlet boxes shall have a locknut on the outside of the box, and only sufficient thread for a bushing inside of the box. The same arrangement holds good where conduits enter panelboard boxes as well as junction or pull-boxes.

For all ceiling fixtures in fireproof buildings, an independent fixture support shall be furnished, and under no circumstances shall a fixture stud be depended on as a support. The fixture support can be made of three-eighths-inch iron pipe, flattened on one end and a long running thread on the other end. The flattened part of the three-eighths-inch pipe can then be formed into an eye to receive a one-half-inch or a three-quarter-inch conduit for a crossbar, which will then rest on the fireproofing above. The long running thread in the outlet box is for the purpose of receiving a three-eighth-inch locknut on both sides of the box, which will also serve as a support for the box where conduits are being arranged for it.

Floor Outlets.

Where electric light or any other outlets are required in the floor, cast-iron boxes must be used for such purpose. They shall be provided with threaded connections and the joints shall be made watertight with either red or white lead. Each box shall be provided with a floor-level arrangement. In all cases a floor plate with a flanged ring shall be provided for the protection of the floor when inserted in concrete or tile. If floor box is used for electric-light purposes, it should be arranged to contain a plug receptacle of the standard make. All finished floor plates shall be provided with nozzles according to the use intended. All fittings must also be provided with rubber packing to make the box watertight.

Where floor outlets are required for telephone, telegraph or push-button or fire alarm systems, time clock, stamp or other purposes of this kind, and outlets are required beside each other under a desk, a sectional floor box should be provided for such a purpose, and each system should have a separate connection independent of each other. The construction of this sectional floor box must comply to floor box described above.

All conduits, bends, connections and fittings must be carefully examined after being delivered at the building, and again before being installed, and all material that does not conform to this specification in quality of material or finish shall be rejected and removed from the premises.

No conduit larger than three-quarter-inch inside diameter shall be used on the branch distribution circuits, and not more than two duplex No. 14 wires or five single wires, No. 14, shall be drawn into it. One-half inch conduit may have one duplex, or three single wires, No. 14, or one duplex and one single wire, No. 14, drawn into it.

Supports.

All conduits shall be properly supported when used as vertical risers or in a horizontal run. Supports shall be not less than four feet apart on horizontal runs, and consist of clamps secured to the floors of buildings by means of expansion or toggle bolts. Where conduits are built in concrete-floor structures they shall be located so as not to reduce strength of concrete slabs. No conduit shall come in contact with or be fastened to any other pipes in the building. Where conduits are used for vertical risers they shall be supported every 35 feet, and all of these supports shall consist of cable racks with pull-boxes. Where conduits terminate at the pull-box, the insulated cable shall be supported on porcelain clamps in these pull boxes. All conduits in every class of construction shall form a continuous metallic connection from outlet to outlet, and to panel boxes.

Conduits used for open or visible work must be supported in the manner called for above, but in no case shall nails be used for pipe straps or other supports, and all fittings shall be supported with either wood or machine screws.

In all classes of construction conduits must be thoroughly grounded, in the manner called for by the National Board of Fire Underwriters, except in fireproof steel structures. Where conduits are in direct contact with the steel structure no extra ground will be required.

Pull-Boxes.

Where conduits and feeders are to be supported on horizontal runs on the ceiling, a pull-box should be inserted at least every 150 feet. In case of angle bends or turns, it is recommended that long sweeping bends should be made, especially where cables heavier than 4/0 are to be used. It may also be advisable to use a pull-box to relieve the strain of pulling cables. All large pull-boxes must be arranged for porcelain supports, so the weight of the cable will not bear down on the covers in such box. All pull-boxes should be made in sections and put together with screws or bolts, and not with rivets.

Cabinet Boxes.

Cabinet boxes must be made of No. 10 gauge sheet steel, and be of a built-up type of construction, properly stiffened with steel angle-iron corners thoroughly riveted together and provided with the necessary lugs, etc., to support the panel lining The front must be made from a single sheet of steel with door opening in same, leaving a frame of proper width all around. the door to be made of a single piece of steel, carefully fitted to its frame and closing against suitable rabbeted strips and properly stiffened and hung on heavy pressed-steel hinges. For panels of from one to ten circuits the doors must be provided with spring hinges; for panel boxes over and above ten circuits the doors shall be provided with self-locking bolts and nickel-plated vault handle, and all doors for panel boxes must be provided with Yale locks and duplicate keys.

Wiring.

Before any wire is drawn into any conduit system the following must be observed:

First—On the ceiling work no wire shall be drawn in pipe until building has received at least its first coat of plaster.

Second—All conduits must be free from moisture or water that may have gotten into the pipe from bad joints in pipe or condensation; then the conduit should be saturated with soapstone and wires drawn in. Under no consideration shall oil or grease be

used for either branch circuits or cables to be drawn in the conduits.

Where wires are drawn for branch circuits there should be eight inches of wire left at either the ceiling or bracket outlets, and at least twelve inches of wire left in the panel box, over and above that required to go under a binding post or terminal on the panel-board.

On wires in sizes No. 10 to No. 14, nothing but hand labor shall be used to draw them in the conduits. On cables heavier than No. 8, block and tackles may be used, but the cables must not be submitted to undue strain so as to injure the insulation.

Splices in wires must be made as follows: Care should be taken to remove the rubber compound from the copper. But in doing this be sure that the insulation is not cut with a knife at a sharp angle to the wire, and thus prevent cutting the wire itself, so that when bent under a terminal for the purpose of making a splice, the wire will not break; remove the insulation in a tapering manner, as one would sharpen a pencil; also be sure that the tin on rubber-covered wire is not scraped off the wire by cleaning the insulation, as this will then protect the copper from corrosion. Splice should then be made in a substantial manner and carefully soldered, the acid or paste washed off and the joint dried before tape is applied. Then two coats of a high-grade rubber compound should be wrapped on this joint (the compound should be carefully stretched before applying); then one layer of cotton tape should be applied over the rubber compound, and on cables larger than No. 4 the ends of the cotton tape tied with thread so it will not come loose; in all cases the cotton tape will receive two coats of insulating paint before the joints are left.

All wiring should be arranged for not more than 500 watts in any one branch circuit in fireproof buildings; it is also desired that three-quarter-inch conduit be used between the panel board and the first switch outlet or ceiling outlet, and that no more than one branch circuit be placed in this three-quarter-inch conduit when the work is designed or executed. This will then permit increased capacity if desired. When cables are used as feeders in fireproof or office buildings in vertical positions, the ends of cables should be supported in strain insulators and turnbuckles, so that slack in the cable can be taken up any time, and not be exposed to the danger of grounding at the bottom of shafts or elbows. Where taps are taken from cables for the purpose of branch wiring, when the feeders are larger than No. 4 B. & S., the branch or tap wire should be threaded through the cable and soldered, etc., and not wound round on the outside of the cable.

Where a tap circuit is taken off a feeder to supply current to a panel-board, and the main feeder is within three feet of the lugs of this panel-board, all such tap wires should be at least 25 per cent larger than the entire capacity of the panel-board.

For alternating current, wires of branch circuits or feeders should be placed in the same conduit, whether for power or for lights. For power wiring the same general specification shall govern as for lighting, with this exception: for power purposes it is desired to divide the system in center of distribution, and concentrate the fuses controlling the various subfeeders and branch circuits in one place. This however will not prohibit the use of a subfeeder controlling three, four or five horsepower motors on one main fuse. Taps may be taken from this subfeeder to each five-horsepower motor and the fuses placed near the motor, providing the tap wire is the same size as the submain. It is also preferred to provide circuit-breakers on power distributing panels instead of fuses for feeders supplying over 10-horsepower. Circuit-breakers can be placed at the main distributing panel, just as fuses are.

Panel-Boards.

Panel-boards may be made of either slate or marble. In either case materials should be selected that are free from metallic veins of any description. The slate or marble for panel-boards of 10 circuits or less should be at least one inch thick, and for over that number of circuits should be at least one and one-half inches thick. All panel-boards should be provided with a four-inch gutter all around. All side linings should be at least three-quarters of an inch thick. Side lining should be provided with slots for branch wires leading from the gutter to the branch circuits, and no holes should be drilled inside liners for branch wires to be drawn through them for the purpose above indicated.

All slate and marble panels should have at least a three-quarter-inch space between the back of the panel and the sheet metal frame for the purpose of air ventilation, when panels are placed either on or in brick walls exposed to outside-air contact. All marble or slate panels including linings should be supported on iron frames or boxes and should be supported with machine screws or studs, and holes in all work should be threaded, but no nuts shall be used at the end of board where they cannot be gotten at from the front.

Panel-boards should be provided in all cases with substantial busbar work. Busbars, whether for vertical or horizontal runs or for main feeders or branch circuits, must not be less than three-sixteenths inch thick, in order to have a sufficient number of threads for screws that may form a contact or support between any two busbars. Busbars placed on panel-boards must be arranged so that they can be removed from the front of the panel-board without removing this panel-board from its iron box or support. This can be done by using screws with nuts countersunk in the rear of the panels and these nuts leaded in the countersunk holes. This arrangement must also be applied to parts of switches, fuse blocks and fuse clips.

Branch circuits on panel-boards must be provided with knife switches of 25-amperes capacity each; also with plug or cartridge fuses. On the hinges of branch switches, threaded studs with spring washers and nuts must be used. Rivets on these hinges will not be permitted. All screw heads used on the surface of busbar work for panel-boards must be proportioned to the lift of the busbar they serve, so that larger busbars shall have large proportioned screw heads to give a substantial appearance. All panel-boards should be provided with a main switch and main fuses to control the total capacity; also receptacles with either plug attachment or lamp base for inspector's use, and in all cases these receptacles shall be connected to the switch terminal; must also have fuses provided so that in case the main switch of the panel-board is open, light can be had from this receptacle for the purpose of doing repair work in and around the panel. On the larger installations where there is a three-wire system for feeders, it is preferred that two receptacles be used in each panel-board and connected to each side of the three-wire system, and these receptacles connected to a different set of mains than that in the respective panel-board the receptacles are installed in.

All switch handles, whether for branch or main fuses, must be of the spade-handle type, and for the switches below 50-amperes must be made of compressed fiber, and for switches over 50-amperes, they can be made of hardwood saturated in a waterproof compound. On large switches it is also desirable that the spade-handle shall be bolted to the cross bars and under no consideration shall the switch blade serve as a terminal support for a spade or any other kind of handle.

Slate panels described above shall only be used up to 440 volts. For larger

voltage blue Vermont slate is preferred.

The above specification governs all classes of electrical work in buildings used for railroad purposes, and where anything special is required, the following condition must be followed.

Wiring in Buildings of Other Types.

In round houses, the conduit shall be placed below the smoke line, either on the outside or on the inside of the outer walls, directly above the windows. If conduits are placed on the outside of the wall and taps are taken through this wall for branch circuit purposes, a watertight junction box shall be placed at this point, and fuse terminals with fuses in a cast-iron box shall be placed at the bottom of such tap circuit. Tap circuits shall also be of the same size as the outside main. If the conduits are used for any purpose underground, they shall be placed at least 12 inches below the finished floor and imbedded in concrete. Where conduits enter the floor or are brought out of the floor to the wall above, there shall be a cast-iron casing put over the conduits and this casing extended 6 inches below and above the finished floor line.

For the general illumination of a round house, a cluster of tungsten lamps with porcelain enameled reflector will better serve the purpose, but this part of the work will have to be determined for each individual case. For plug-receptacle outlet boxes, nothing but cast-iron fittings with threaded connections may be used. In all cases the work should be made as nearly watertight as can possibly be.

Conduits placed on walls either inside or outside of the building should have a space between the conduit and the brick wall to reduce condensation to a minimum. In all cases, however, no pocket should be left in the conduits where the condensation would form into water.

In boiler rooms, conduit should be kept below the line where temperature and smoke may have an injurious effect on the conduit or the insulation of the wire. It is preferred that the main supply should be run not over 15 feet above the floor, and branch circuits taken off of this main for the various groups of lights used for general illuminating purposes. For lights used to illuminate water and pressure gauges, conduit should be run on top of the brick work of the boilers, and a fireproof insulated wire must be used in these branch circuits.

Individual lights must be suspended on rigid pipe brackets at the rear of the boiler, and separate circuits must be run for general illumination; also for a receptacle at the rear of each boiler for extension cords.

In the engine room, the work in general, shall be done in the same manner as in boiler rooms, except where individual lights are supposed to be erected on and around frames of engines, all conduit work shall be started from the top of the engine and the branches run down; all fittings and joints to be made waterproof to avoid oil seeping inside of the conduits.

In machine shops the work in general will have to be laid out as best adapted for the class of work to be done in these shops. For general illumination and for power, feeders should be brought to main distributing centers and from there, subfeeders or branch circuits should be run to the various outlets, the object being: the fuses or circuit-breakers controlling subfeeder or branch circuits should be concentrated as much as possible and not be scattered throughout the building. For illumination, large tungsten units are best adapted, except that individual receptacles with extensions should be provided at each machine for general use around the work.

For power purposes in machine shops it is preferred that each motor should be controlled by individual mains, but two or three small motors can be connected or supplied by one subfeeder, and taps taken from this subfeeder to each individual motor should be the same size as the subfeeder itself; and in addition to fuses or circuit-breakers in the main distributing panel, it is necessary that a circuit-breaker be located at each machine tool operated by an electric motor, and this circuit-breaker should be controlled by one or more push buttons placed on this machine tool, usually accessible to the operator for the purpose of immediate and quick opening of the circuit in case of emergency. Circuit-breakers should be inclosed in iron boxes set on pedestals, columns or walls as conditions may require, and each iron box should have a door with hinges on the left side.

Extension cords for machine shops, engine rooms and boiler rooms should be of flexible metallic incased conductors with either Hubbell or other stage-pocket attachment, wood handle, key socket and wire guard.

Main feeders for power in machine shops should be at least 70 per cent of the aggregate capacity of the motors connected or to be supplied by this feeder. Branch or sub-mains should be at least 100 per cent of the capacity of the individual motors they are supposed to supply.

For alternating current, feeders should be at least 200 per cent larger than the motors they are supposed to serve.

For coal sheds and chutes open conduit work should be used. Cutouts should be placed in rooms not subject to coal dust or moisture. Pendants supporting sockets or lamps must be made of rigid pipe. Sockets and lamps should be protected by waterproof outer globes. Switches controlling lamps should be placed in rooms free from coal dust or moisture.

For cinder and ash pits wires should be run open from the nearest building, supported on poles, and brackets should be furnished to support the socket, lamps and reflector. The lamp is to be placed about 18 feet from the ground, at an angle of 45 degrees, size of the lamp bracket and reflector to be determined by the purpose they are to serve.

Passenger stations and platforms for same must be grouped in the manner described above.

For freight stations and loading platforms open-conduit work may be used. Inside of the freight house, the conduits can be run on rafters alongside of the walls and branches for the various outlets taken from these mains and carried over the long rafters to the center or point where the outlet is required. In no case shall conduit be run from rafter to rafter having open space between where conduits would be exposed to injury by freight handlers. Service and distributing centers shall be placed in offices of freight stations, and not in the freight house proper, so that all fuses, switches, meters and other controlling devices should be out of the way from any possible injury by freight handlers or other elements.

On lights for loading platforms, all work should be considered as weatherproof, and for that purpose, all fittings should have cast-iron, threaded connections, made watertight with red lead. In addition to the general illumination of loading platforms, plug receptacles should be provided at least every 30 feet for extension cords to be taken inside of freight cars; but the plug receptacles should be connected to a different circuit than that furnishing the general illumination of the loading platform. It is furthermore very essential that no more than five receptacles shall be placed on any one circuit.

On all work described in the above specifications, for the details of construction and the general selection of materials, the National Underwriters' rules shall be considered part of these specifications.

Copper Exports.

Exports of copper for the week ending October 30 totaled 3,616 tons; since October 1, 27,689 tons; same period last year, 24,670 tons.

An Unusual Combination of Circuits.

A storekeeper had two meters, one to measure electricity for the rooms over the store, the other for the store. He wanted to connect an advertising sign at the front of the store, to be controlled by a switch at the front, with the least expense for wiring up

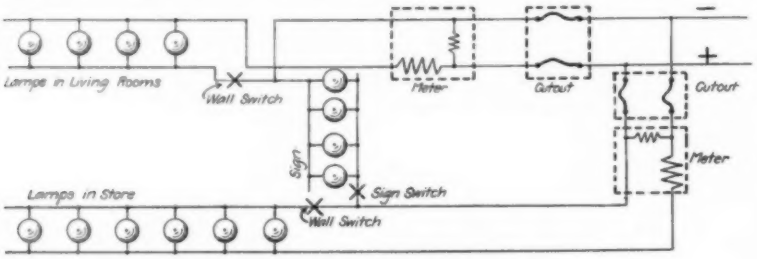


Fig. 1.—Arrangement of Circuits.

the sign. The two wall switches, one upstairs and one downstairs, offered the most convenient points of connection and happened to be of opposite polarity; so the sign lamps burned.

After the sign, which burned until midnight each night, had been connected for a month the merchant expressed surprise that his bill did not increase, which caused us to investigate.

We found that neither switch wire tapped a series coil in the meter.

If the wires to either meter were reversed separately the sign lamps would not burn. The only expedient was to reverse the wires to the store meter and carry the wires that tapped the upper wall switch back through the series coil of the upper meter.

It might also have happened that the sign current would be measured by both meters if the wall switches had both tapped the opposite side.

Charles E. Warsaw.

A Short-Circuit from a Remarkable Cause.

The following is a description of a most unusual short-circuit that occurred in a conduit system in a large office building in this city. The meter is located at *A* and feeds to wall brackets at *B*, *C*, *D*, and *E*. When the short-circuit took place, tests showed it to be between the meter and wall bracket *B*. The building had been wired many years, and nothing had ever occurred of a like nature. Everything is in pipe, and there are no junction boxes in the building.

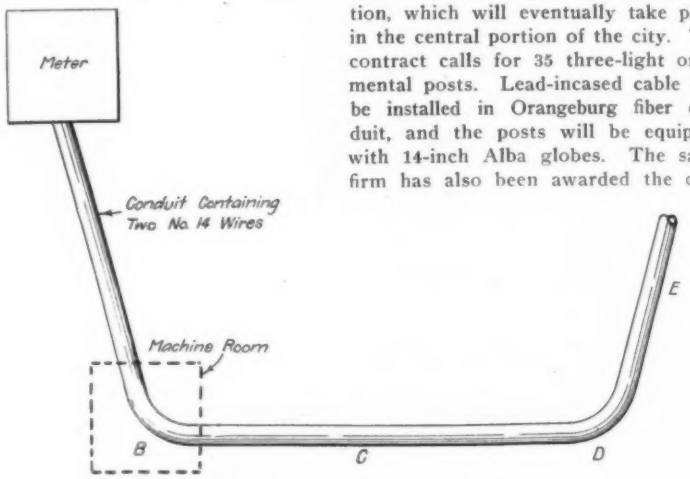


Fig. 3.—Conduit in which Short-Circuit Occurred.

Directly over the wall bracket *B* is the machine room of the passenger elevator, and the constant jarring of the walls and ceiling at this point caused the twin wires in the conduit, which passed over or rather near this point, to become bared of insulation at a joint in the conduit that happened to be poorly made. It was necessary to run in a new feed outside for the brackets, for the old feed could not be pulled out of the pipe. Fig. 2 shows the arrangement.

William E. Rhodes.

Simple Tool for Slotting Commutators.

A tool which I find very convenient for use in undercutting commutators on direct-current machinery is shown in Fig. 2. It is made of any good knife which has the shape shown and has a steel blade. The tool should be about

Fig. 2.—Tool for Commutator Work.

eight inches long and one inch wide. The teeth can be cut with a three-cornered file. It is understood, of course, that the blade should not be too thick to pass readily between adjacent copper segments of the commutator.

James J. McCartin.

Among the Contractors.

The Inland Electrical Company, a new concern, has opened offices in the Hubbell Building, in Des Moines, Iowa. The company was organized by J. A. Teas, and will confine its contracts for electrical wiring to large jobs. It will do no residence wiring.

The J. H. F. Buchannan Electric Company, of Philadelphia, Pa., has been awarded the contract for installation of electric lighting and motor wiring in the new plant for the City Baking Company, Baltimore, Md. This plant will be the largest baking plant in that city, and will have a total output of 125,000 loaves of bread per day.

The Central Garage & Supply Company, of Hagerstown, Md., has just secured the contract from the city of Hagerstown for installing a White Way on the principal business blocks. This is the first part of the installation, which will eventually take place in the central portion of the city. The contract calls for 35 three-light ornamental posts. Lead-incased cable will be installed in Orangeburg fiber conduit, and the posts will be equipped with 14-inch Alba globes. The same firm has also been awarded the contract for the electrical installation in the new Odd Fellows Building.

Among the contracts which Frost & Sheldon, of Albany, N. Y., have under way is that for the rewiring of the old State House in Albany. This building is now occupied by the state comptroller and the state engineering offices.

Barnes & Payton, of Troy, N. Y., are installing the electrical equipment in the new Samaritan Hospital in Troy. The contract price approximates $16,000.

The Wiliams Electric Company, of Ithaca, N. Y., has just been awarded the wiring of the Delta Chi Fraternity House, in that city. The work will amount to about $1,000. This firm is just completing about $5,000 worth of electrical work in a dormitory building of Cornell University.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

An Instrument Convenient in Testing Inside Wiring.

In testing electrical installations for grounds I find the following inexpensive and efficient.

Take an ordinary telephone receiver and to it attach a pocket flashlight battery; connect one terminal of battery to one terminal of the receiver, and from the remaining terminals take two flexible leads. To make a test connect one lead to the installation and touch a grounded pipe with other; if there is a ground on the installation, a distinct "click" will be heard in the receiver. If the grounded wire is in a conduit, the point of grounding can be located by disconnecting the grounded

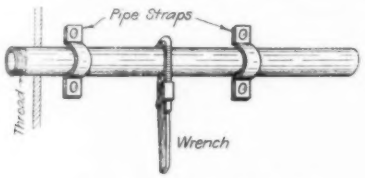


Fig. 1.—Plan for Holding Pipe.

wire in sections at outlet boxes and using conduit for ground connection.

John Shortt.

[A device similar to this is used regularly by many electrical inspectors.—Editor.]

Protecting the Split Knob.

It is estimated by electrical contractors that 10 to 20 per cent of the split knobs on a job are lost by breakage. I found that on driving caps down on the wire either the edge of the cap or of the body would break away. This did not spoil the knob, as there were still grooves that could be used; but the difficulty was to draw the nail enough to allow the knob to be turned without splitting the cap altogether. I overcame this by using nails long enough to project a quarter inch or so on the opposite side of the joist or stud, in which case a tap with a hammer would drive them back enough to allow the cap or body to be turned around.

John Shortt.

Paraffin as a Lubricant.

A wiring kink in the issue of October 18, by O. S. Livergood, suggests the use of paraffin to lubricate wires in conduit work, to facilitate drawing them in. This is bad practice, especially in circuits where, because of an overloading of the wires, or for any other reason, the interior of the pipe is liable to become hot enough to melt the paraffin. My notion is that the melted paraffin is very bad on the insulation. Moreover, it may collect and harden in such masses as to make the drawing in of other wires at some later time next to impossible, and it renders the wires on which it was originally used practically unfit for use again, in

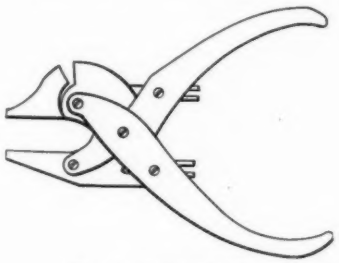


Fig. 2.—Staple Cutter.

case they should ever be pulled out of the pipes in which they were first installed. Soapstone is the thing to use.

W. P. Campbell.

Wiring for An Additional Bell.

Recently I was required to place a second bell upstairs to ring from the front-door push button when the kitchen bell rang. The wiring was all covered, except for a short space where both wires leading to the push button were available. The construction of the house was such that additional wires could not be fished to the push button.

I ran in the circuit for the second bell and placed a battery for it in the basement; then I connected to the ex-

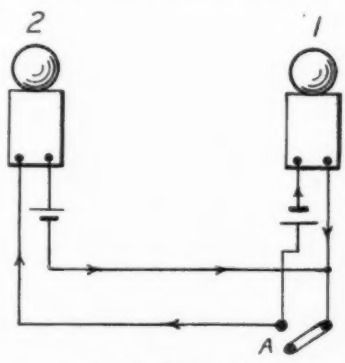


Fig. 3.—Bell Circuit.

posed wiring of the first bell as shown in Fig. 3. When the push button at *A* is open the batteries are opposed to each other and no current flows. When the push button at *A* is closed both batteries assist in ringing the bells.

F. H. Geer, Jr.

Removing the Wires Without Breaking the Plaster.

In removing wirest that have been fastened on plaster walls with staples, I always cut the top of the stable so that I can pull out half of it at a time. By doing so I only leave the small holes which the staple has made and do not break off a great scale of plaster as is generally done when removing the staples whole. All sizes of staples can easily be cut with pliers similar to those shown in Fig. 2.

W. E. Griswold.

Threading Conduit Without a Vise.

To cut threads on conduit when there is no vise on the job, simply fasten the pipe to be threaded against a wall with straps or nails in such a way as to allow one end to project into an open door. Then place a pipe wrench on the pipe with the handle resting against the wall in a way that will prevent the conduit from being turned by the twisting of the die stock. If this scheme is worked properly, it makes the best substitute for a vise. It is illustrated in Fig. 1.

James Clancy.

Bending Fixture Arms.

In my work as an electrician I sometimes find it necessary to bend the arms of fixtures for electric lamps, and

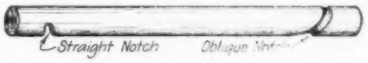


Fig. 4.—Tool for Bending Fixture Arms.

the simple tool illustrated in Fig. 4 has proved to be very serviceable when this kind of work has to be undertaken. It is made of a round piece of walnut wood about 12 inches long and 1 inch in diameter. In one end of the stick a deep notch is cut across at right angles to the length, and at the other there is a groove that passes spirally around.

R. A. McMahon.

Bending Conduits.

It is sometimes very hard to make an L-bend in a conduit as accurately as one would like when the work is confined to the use of standard bending devices. I find it a good plan to make the ell a little longer than it is to be left. Then the bend can be made just the right length by slipping a piece of larger conduit nearly down to the bend, bending the conduit forward a little, dropping the larger pipe down to the bend, and finally bending the conduit back. In this way, it is quite easy to take an inch or so out of the ell.

Roy Ellerthoyse.

Public Service Commissions

MARYLAND.

The Consolidated Gas, Electric Light & Power Company has been authorized by the Public Service Commission to issue 4.5-per-cent bonds to the value of $800,000. The proceeds will be used in acquiring property and in extending the company's plants. The company is ordered to report to the Commission the sale or disposal of the bonds and the disposal of the proceeds at regular intervals.

MASSACHUSETTS.

The Gas and Electric Light Commission has approved the issue of 2,650 shares of new stock, at $200 per share, by the New Bedford Gas & Edison Light Company. The proceeds of 1,900 shares are to be used to pay notes outstanding June 30, 1913, and of 750 shares to pay the cost of additions made after that date.

Hearings on the complaint of the Postal Telegraph-Cable Company against the New England Telephone & Telegraph Company, charging discrimination in favor of the Western Union Telegraph Company in the sending of messages, were held last week by the Massachusetts Public Service Commission. The Postal claimed the Telephone company delayed connections and diverted business intended to be handled by its lines, during three years since the American Telephone & Telegraph Company acquired control of the Western Union. The petition of the Postal Company asked that the Commission forbid such alleged discrimination. Evidence was offered by its attorneys to show that attempts of patrons to become connected by telephone with its own operators for the purpose of transmitting messages had been unsuccessful in certain specified instances; sometimes the telephone company's operators suggested the Western Union, and in other instances the telephone operators' response was that the Postal's lines were continuously busy.

The Telephone Company's defense was to the effect that the cases cited were merely mistakes and that no discrimination exists. Its attorney stated that in September, 1912, an order was issued to the telephone operators requiring that unless a subscriber stated which telegraph company is desired, the operator must refer the call to a supervisory operator. These instructions have sometimes been misunderstood or forgotten. A record of telephone calls for the Postal Telegraph office in Boston for October 21-24 showed that of 739 calls only 12 cases occurred where the line was busy. The attorney doubted if operators generally knew there was any affiliations between the New England company and the Western Union. A diagram was presented to show the increased probability of errors that would result from a change to the call number system for telegrams.

NEW HAMPSHIRE.

The Public Service Commission has disapproved the terms of a proposed lease of the property and franchise of the Jeffry & Troy Electric Light Company to the New Hampshire Water & Electric Power Company, of Boston, Mass., for 99 years at $3,350 per year, a sum representing 10 per cent on outstanding stock, interest at 5 per cent on outstanding bonds, and 5 per cent sinking fund. The Commission says the rental ought not to exceed 6 per cent per annum on $15,000.

The Commission has authorized the New Hampshire Water & Electric Power Company of Boston to issue capital stock to the value of $50,000 to cover new construction. The company recently built an electric lighting plant at Fitzwilliam. The petition for authorization set fourth that $41,378 had been expended in construction work. In addition, the company wished to capitalize construction interest, covering about 16 months, the last six months being while the company was building up the business. The Commission held that construction interest for the last six months was not properly to be capitalized. Such a procedure would imply the theory that sufficient capital should be authorized for the payment of dividends out of capital until sufficient business is developed to allow their payment out of the earnings, which the Commission holds is not a sound one. A recent state law provides that dividends may be declared only out of net income.

The Commission allowed 4 per cent for construction interest, figured on a year's actual construction. The company wished to capitalize cash organization expenses, $239; general organization expenses, $1,816; legal, expert and engineering expenses, $3,650. The Commission disapproved allowing amounts paid to promoters and for "payments the nature of which was not stated" to be capitalized.

NEW JERSEY.

The Board of Public Utility Commissioners has denied the application of the Farmingdale Lighting Company for permission to issue capital stock amounting to $3,000, and bonds to the extent of $20,000, for working charges, engineering charges and incidental expenses, the sale to yield in total $20,000. In its decision the Board states, after making investigations, that the total amount of cash required by the company is $16,000, and it cannot allow securities in excess of this sum; it therefore recommends that the company file a new application for permission to issue securities to such amount.

The Board of Public Utility Commissioners has issued an order requiring the Delaware & Atlantic Telegraph & Telephone Company to install a telephone system at Ashland, making such extension from its exchange station at Haddonfield. The company contended that its lines should be extended from Laurel Springs, being nearer to Ashland than Haddonfield, and in more reasonable adjustment of its zones from the Laurel Springs exchange; the municipality held that a telephone service in the Haddonfield zone would be of greater value. In deciding this point the Board says: "While we are inclined to think that the company should primarily be left free to lay out its distribution system in the way that in its opinion will best serve the interests of the public considered as a whole, yet if the layout of its distribution system is inconsistent with the present requirements, as well as the natural growth and the development of the community to be served, it should not be allowed. We are inclined to believe that because of the fact that Ashland is situated on an entirely different railroad from Laurel Springs, that its natural growth and development is logically toward Haddonfield, and that a comparatively small difference in investment is involved in connecting it with either of the two mentioned places, the service for Ashland should be supplied from the Haddonfield exchange."

The Board of Public Utility Commissioners has handed down a decision ordering the Public Service Company to pay $2,644.46 annually for the use of the Clay Street bridge, Newark; one-half to go to Essex County, and the other to Hudson County. This order is in accordance with the recent law passed by

the Legislature, empowering the Commission to fix compensation when a municipality and traction company could not agree as to a satisfactory rate for the use of bridges, which was evidenced between Boards of Freeholders of Essex and Hudson Counties and the railway company in this instance. The ruling authorizes payment to begin from August 4 last, when service was resumed over the bridge, and establishes a precedent in the state.

The Board of Public Utility Commissioners has issued a general memorandum calling the attention of public utility companies to the statute which provides that such corporations shall not issue bonds nor obligations of any character except in return for cash or property amounting to at least 80 per cent of face value, and to the jurisdiction of the Board over all bond issues. Attention is called to a court decision under a similiar law in Wisconsin (Pfister *et al vs.* Milwaukee Electric Railway Company *et al,* 53 N. W. Rep., 27). In this case bonds of the face value of $250,000 were given by the company as a collateral security for a loan of $125,000. The court ruled that the bonds were void.

WISCONSIN.

The application of the Ettrick Telephone Company for authority to extend its lines into the town of Glasgow has been denied by the Wisconsin Railroad Commission. The territory in controversy is at present served by the Western Wisconsin Telephone Company. It appeared from the testimony that a considerable number of the Western Wisconsin Telephone Company's subscribers were interested in the proposed extension and contemplated taking service from the petitioner, in case its application was granted, because of the exceptionally low rates offered. It appeared that the petitioner could offer low rates because it did not maintain an adequate depreciation fund, it did not pay adequate wages to its operators, and the service rendered is poor. The Commission held that the company at present in the field could not be expected to, nor is it in a position to, lower its rates as would be necessary if competition were permitted. The low cost of service under the conditions that exist was held not to be a sufficient justification for the entrance of the applicant into the field as a competitor.

The La Crosse Gas and Electric Company has been authorized to issue $126,000 in 5.5-per-cent bonds. The American Public Utilities Company, which recently acquired this property, contemplates the complete rehabilitation of the electric plant and the hot-water heating system. The estimated cost of improvements was given as $157,600.

The Green Bay Gas and Electric Company has been empowered to issue $132,000 in bonds to be exchanged for a like amount of outstanding notes.

The Water and Light Commission of the city of Fort Atchison has been authorized to amend the rate schedule prescribed by the Commission last July in so far as it affects certain classes of consumers. Power and heating consumers, whose loads are connected for less than six months, will hereafter have their fixed charge on the active connected load increased by ten per cent, unless the load is used during other hours than peak loads and satisfactory measures be taken to prove such times of use. Temporary users of energy will be required to pay for all energy at the primary rate. The city is authorized to charge the same rates for heating and cooking service as were subscribed for power service. In this case, 90 per cent of the first 2 kilowatts connected is to be regarded as active, 65 per cent of the next 3 kilowatts, and 50 per cent of connected heating or cooking load in excess of 5 kilowatts.

Central-Station Fires.

On October 16 power plant No. 2, which was being constructed for the Pacific Light & Power Corporation on Big Creek, 75 miles back in the mountains from Los Angeles, Cal., was damaged by fire to the extent of nearly $10,000.

On October 19 the power plant at Goliad, Tex., was completely destroyed by fire. The loss is estimated at about $25,000.

An explosion occurred in the plant of the Richmond Light & Railroad Company, at Livingston, Staten Island, on October 21. Six men were killed and four injured and a portion of the plant was wrecked. There were two separate explosions in the boiler room shortly after five o'clock in the morning. This plant supplied the electric car lines on the island, as well as current for lighting and power.

The Greenspring Electric Light & Power Company's plant at Greenspring, O., was almost completely destroyed by fire early on the morning of October 26.

Los Angeles Aqueduct Completed.

The aqueduct which has been built at a cost of $26,000,000 to supply the city of Los Angeles, Cal., with water from the mountains has been completed and the gates were opened this week, admitting water into the San Fernando reservoir. The aqueduct is 260 miles long and has required eight years for its completion.

The municipality expects to develop 47,000 horsepower from hydroelectric plants, which will supply the city with light and power.

Sun River Development.

The Sun River Valley in Montana is entering upon an era of electrical development which is to hasten the completion of one of the Government's huge irrigation projects.

Seventy miles of transmission line have been built, extending from the Rainbow Falls hydroelectric plant of the Great Falls Power Company on the Missouri River, westerly through the entire length of the valley to the base of the mountains, where the principal diversion dam is now under construction across Sun River. The electrical energy, transmitted at a voltage of 110,000, is stepped down at three transformer stations, from which it will be distributed to the principal features of the work. It is now being used at the Sun River diversion dam, operating pumps and air compressors, concrete mixers, derricks, and in lighting the construction camp and the site of the work. The Government is constructing a distribution line along the Pishkun Reservoir and the Sun River Slope canals, a total distance of 44 miles.

The contract for the excavation of the main canals and laterals has been awarded and the contracting company is having special power shovels and dragline scrapers designed and constructed for the work. All power machinery on the work will be operated by electricity, including the air compressors on the tunnel work.

The exclusive use of electrical energy in the construction of an irrigation project, including the excavating of the canals, marks a radical departure from the old order of things, and a new epoch in construction work. It is believed that a considerable reduction of cost and time will be achieved.

The power company is bound by the contract to extend the present trunk transmission line 30 miles, when required by the United States, at right angles, entirely across the project. This will make available at the outset electrical energy for each of the towns now on the project and the considerable number of new towns already projected along the three new lines of railway which are being constructed across the project, giving them cheap light and power for manufacturing and allied uses. They may also follow the example of the towns on the Minidoka project in Southern Idaho, where many of the homes, business houses, and public buildings, are heated as well as lighted by electricity from the Government power plant.

The Sun River project involves some of the largest features of construction work yet undertaken by the Reclamation Service, and the results obtained by settlers on the Fort Shaw Unit justify the expectation that this will be one of the most satisfactory of the northern projects.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 175.—Two-Rate Meters.—Has any American central-station company employed two-rate meters for residences and other small customers connected to its miscellaneous lighting circuits? What method is used to change from the low rate to the high rate during the time of peak load and back again? What effect has this had on the peak? Is the time of high rate adjusted during the different seasons to correspond with changes in the station peak? Does the two-rate meter eliminate the need for primary and secondary rates based on maximum demand? What is the relative cost of a 10-ampere, two-rate induction meter compared with a similar standard meter?—V. P. B., Milwaukee, Wis.

No. 176.—Wireless Telephony.—What is the greatest distance over which wireless telephone communication has been attained? Is this affected by the same conditions that affect wireless telegraphy?—J. S. C., Missoula, Mont.

No. 177.—Reissue Patents.—What is meant by a reissue patent? What is its life? I have always thought that patents cannot be renewed in this country and only recently ran across a reissue patent.—N. A. A., Troy, N. Y.

No. 178.—Automobile Headlights.—Several cities have agitated and I believe Chicago has passed an ordinance forbidding the use of glaring automobile headlights. Is any simple dimming device on the market for cutting down the brightness of electric headlights in the city, which is arranged to permit full brightness when a dark stretch of country road is reached? —H. J. W., Morgan Park, Ill.

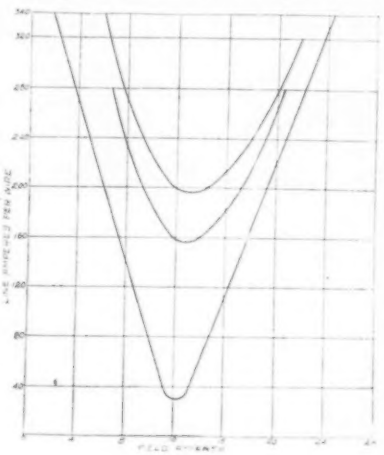
No. 179.—Gold From Sea Water.—I understand that attempts have been made to extract gold electrolytically from sea water? What success has been attained? Is it a commercial process?—S. M. P., Toronto, Ont.

No. 180.—High-Capacity Storage Batteries.—In storage batteries for automobile use, what is the highest capacity in kilowatt-hours per pound of complete cell that has been obtained?—A. C., St. Paul, Minn.

Answers.

No. 165.—Synchronous Motor for Line-Voltage Regulation.—A short time ago I heard of the use of synchronous motors on a transmission line to keep the voltage constant at the receiving end. Is this method dependable and is it much used?—N. P. T., Fort Wayne, Ind.

For any given load on a synchronous motor, the armature current is at a minimum for a certain critical value of field excitation, see illustration herewith. At this point the motor constitutes a load of unity power-factor, the current taken by the motor being neither lagging nor leading. For weaker field excitations, the current taken by the motor is lagging and establishes an artificial drop in the line (which is the condition that we wish to prevail under light-load conditions on the transmission line); for stronger field excitations, the current taken is leading and while adding to the full-load current, the leading current overcomes the drop due to the load itself, with a proper amount of reactance, etc., in the circuit. Therefore, controlling the excitation of the synchronous



No. 165.

motor is a means of varying the power-factor of the transmission circuits with either a lagging wattless current, no wattless current, or a leading wattless current.

The fact that the lagging current taken by the motor to establish an artificial drop under light-load conditions, and the fact that the leading current taken by the motor to overcome the load drop under full-load conditions, and the fact that the motor when running at unity power-factor at about half load has no effect on the line characteristics, justifies the following conclusions: That if the motor excitation be adjusted for unity power-factor at the half-load line condition, the difference between the generator busbar voltage and the substation busbar voltage will be the line drop under the half-load condition, and that at any load less than half load, with constant generator voltage and proper motor-field excitation, the current taken by the motor will be lagging and will establish an artificial drop in the line, and at any load greater than half load, with proper motor-field excitation, the current taken by the motor will be leading and will overcome the line drop. Therefore, with proper synchronous motor electrical characteristics, it is apparent that the generator voltage and the substation voltage can both remain constant and have a fixed ratio, one to the other, equal to the line drop at half load. Thus, a synchronous motor fills another essential requirement, the control of the voltage regulation and the allowing of a constant voltage being carried at both the generating station and the substations. This use of the motor is dependable and can be made automatic by means of proper regulators.

The synchronous motor can also be so used as to be a factor in the economics of transmission problems in reducing the copper costs, especially where the inherent power-factor is low. To take an elementary example: Suppose that for a transmission line at 100 per cent power-factor, transmitting a given amount of true energy in kilowatts over a given line, with frequency and line drop required to be constant, three No. 4 B&S copper wires are required. Then for the same kilowatts at 80 per cent power-factor, three No. 2 B&S copper wires are required. If by installing a synchronous motor the power-factor could be raised from 80 to 100 per cent, which would mean a saving in cost between No. 2 and No. 4 copper, this saving, with wire selling at 15 cents a pound, would amount to $8,900. If this amount of money were to be used annually to pay interest on capital borrowed at 5 per cent, this would allow of an additional investment of $178,000, which would be more than sufficient for the purchase of the additional synchronous apparatus to raise the power-factor from 80 to 100 per cent, and, under certain conditions, would show a net saving.

Synchronous motors for use of both power-factor correction and for voltage regulation purposes will fall under two heads: (a) synchronous motors designed for floating on the line for corrective effect and which do not drive any auxiliary apparatus for furnishing load; (b) synchronous motors designed for driving auxiliary apparatus and having sufficient additional capacity which can be used for corrective effect. The application of synchronous motors falling under both of these classes is becoming quite general and they are of material benefit from both an operating standpoint, in allowing control of line characteristics, and from an economical standpoint in showing a saving in first cost on portions of transmission systems. —L. B. Andrus, South Bend, Ind.

[For a further discussion of this sub-

ject see Mr. Andrus' paper "The Application of Synchronous Motors to a Water-Power Transmission System for the Betterment of Service Standards," *Proceedings*, American Institute of Electrical Engineers, March, 1913, page 721. Also a paper by John C. Parker on "The Industrial Use of Synchronous Motors by Central Stations," *Proceedings*, A. I. E. E., June, 1913, page 1253.—Ed.]

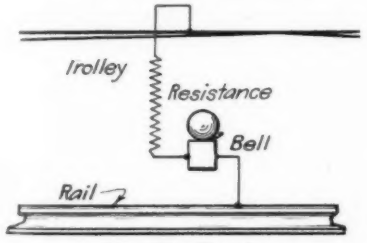
No. 166.—Relation of Tungsten-Lamp Efficiency and Life.—About what is the ratio of life of a tungsten lamp operated at an efficiency of 1.25 watts per candlepower to the life of a similar lamp operated at higher voltage so as to give an efficiency of 1 watt per candlepower?—B. K., Madison, Wis.

While the life-efficiency relation of tungsten lamps is dependent upon a number of factors involving particularly their size, type and construction, the average ultimate service life of tungsten lamps operated at a voltage corresponding to an initial efficiency of one watt per candle will be roughly from one-fourth to one-fifth of the average life obtained at a voltage corresponding to an initial efficiency of one and one-quarter watts per candle.—G. S. M., Cleveland, O.

No. 168.—Electric-Railway Crossing Signals.—Is it possible to arrange a series of highway-crossing signal gongs along a direct-current interurban railway that shall be operated by the line current when a car approaches the crossing without requiring any local batteries? If so, how can this be done?—H. B. W.

Erie, Pa.

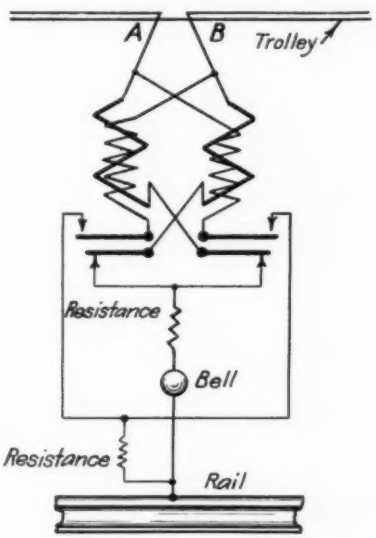
One of the simplest ways is to suspend a light net made of two No. 10 copper-clad steel wires with cross ties every six feet just above the trolley wire for about 750 to 1,000 feet on each side of the crossing, if it is a single-track line. The upward push of the trolley causes the trolley wire to make contact with this wire net from which current is taken to the bell or signal, as shown in Fig. 4. In series with the bell is a high resistance to limit the current; this resistance can be a group of lamps incidentally serving to illuminate the signal and crossing at night. This scheme has the disadvantage of ringing the bell while the car is leaving the crossing as well as while it is approaching it.



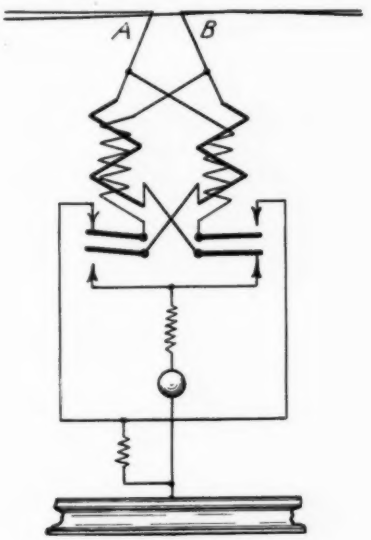
No. 168.—Fig. 4.

A more refined arrangement is made by adding a stick relay with two front and two back contacts and arranged as shown in normal position in Fig. 5. Each core of the relay has about it two distinct windings, one of low resistance and the other of high resistance. As the car approaches the crossing, say from the side *A*, current passes through the low-resistance winding of the left coil but not through the high-resistance winding of the right coil, since its terminal contact is open; consequently current continues to flow through the lower right contact through the resistance and signal to the rail. As the car passes the crossing its trolley passes across the gap in the contact wires and engages wire *B*. Now no current passes through either of the low-resistance windings and none through the bell, because the current through the high-resistance winding of the left coil maintains the two left relay contacts raised as before and shown in Fig. 6. As soon as the trolley clears wire *B* the relay is restored to normal.

Another scheme that can be used is to put along and to the right side of the trolley wire (as approaching the crossing) a No. 8 copper-clad steel wire. Then on the right side of the trolley pole clamp a bracket and small roller to engage the signal wire. This has the advantage of sounding the signal only while the car is approaching the crossing without requiring a relay. Something of this kind must be used when the trolley wire is of catenary construction.—J. S. B., Decatur, Ill.



No. 168.—Fig. 5.



No. 168.—Fig. 6.

No. 169.—Electric Meat Curing and Electric Tanning.—I would like to know where to get some information on the electric meat-curing and electric tanning processes.—A. M. B., Toledo, O.

Electric curing of meat can be done with 60-cycle alternating current passed through the brine tank in which the meat is placed. The ordinary scheme for meat curing is to place the meat in a tank filled with a solution of salt, sugar and saltpeter and letting them remain in this for 90 to 100 days in case of hams and similar sized pieces; the position must be changed often. With the electric current passed through the solution the same results are obtained in 30 to 35 days. In practice the meat is piled on trays in wooden vats about 16 by 4 by 5 feet. The electrodes, consisting of carbon rods or tubes inclosed in unglazed tiles, are located at either end and have diameters of 3.5 inches for carbons and six inches for tiles. The brine, at a temperature of 35 degrees Fahrenheit, is circulated in the tanks by pumps. The current is turned on immediately and continued during the pickling time. The current required is about 30 amperes. Regarding electric tanning, this has been exploited by a Dr. L. A. Groth, of Nalder Brothers & Thompson, 34 Queen Street, Cheapside, London, E. C., England, but the writer has not been able to get any data on the process, costs, etc.—W. M. P., Seattle, Wash.

[For a description of the electric meat-curing process see Electrical Review and Western Electrician, December 25, 1909, page 1233; for illustrated descriptions of plants in Cleveland and St. Louis using the process, see issues of January 8, 1910, page 104, and May 21, 1910, page 1085. An outline of the electrolytic tanning process was given in the issue of December 28, 1912, page 1224.—Ed.]

No. 170.—Changing Fan Motor to Lower Frequency.—Is there any way in which an Emerson fan motor now arranged for 104 volts and 16,000 alternations can be made to run on 104 volts and 7,200 alternations?—J. W. K., Niles, O.

It is impossible to furnish general instructions covering the changing of 133-cycle Emerson fans to make them suitable for operation on 60 cycles. While

instructions have been issued by the manufacturers for changing some types of 133-cycle fans, the number of these fans that can be changed over is only a comparatively small proportion of the total number of 133-cycle fans in use. The only certain way for the owner of the 133-cycle fans in question to secure definite and satisfactory information in regard to changing the fan to 60 cycles is to write to the manufacturers, The Emerson Electric Manufacturing Company, 2024-2032 Washington Avenue, St. Louis, Mo., giving the type number and serial number of the fan. This is also generally true of 133-cycle fan motors made by other manufacturers.—G. H. S., St. Louis, Mo.

No. 171.—Storage-Battery Connectors.—What insulating compound or paint can be used for painting the connectors between cells of a storage battery so as to prevent their corrosion by the acid? I have put glass plates over the cells and this decreases the acid spray, but the connectors still get corroded. They are brass studs with lead-covered nuts. The acid seems to work in between the lead strap and nut.—C. B., Muskegon, Mich.

There are a number of paints and varnishes which can be used for the purpose; they do not, however, give the results that plain paraffin gives. Melt paraffin and apply it with a brush or swab to the parts (which have been previously thoroughly cleaned) that are subjected to the corrosive action of the acid. The paraffin upon striking the cold metal sticks and solidifies. Vaseline can be used for this purpose and is still used to a great extent on car-lighting batteries, I suppose because it is more easily applied. The acid, however, will work under the vaseline and corrode the brass. It will be noted in this connection that the positive terminal is the first affected. Black asphaltum paint or varnish is usually given as an antidote for sulphating of metals, and serves for a time, but eventually the fumes get by this. A compound may be made by melting black ozokerite and thinning it with either turpentine or benzine; the mixture should be of about the consistency of soft putty. This compound may then be used to cover the brass studs. It should be applied, however, in such a way as not to interfere with the conductivity, for the mixture is a good insulator. If there be no objection to taping the joints with friction tape, this may be done, and the joints then painted with black asphaltum paint or varnish and good results obtained.—R. L. L., Minneapolis, Minn.

About the most satisfactory method, to my knowledge, of preventing the corrosion of storage-battery connectors such as described in the above question is as follows: First thoroughly clean the connections by taking them entirely apart and scraping until bright. The threaded portions should be cleaned with a wire brush or by using a tap and die on them. If the lead-covered brass nuts are very badly corroded it would be advisable to obtain new ones. Then apply a liberal quantity of vaseline or light-weight cup-grease to the screw, nut, and the place where the nut hits the terminal strip. After tightening the connection brush or wipe the surplus grease all over the nut. When replacing or changing connections clean off the old grease with gasoline and clean off any spots where corrosion may have started, then grease as before. P & B compound is good for preventing corrosion from acid, but for small parts, such as these, the grease is much superior and more easily applied.—R. W. E., Chillicothe, O.

No. 172.—Water Sterilization by Quartz Lamps.—In sterilizing slightly suspicious water by the actinic rays of quartz-tube lamps, about what quantity of water can be treated per hour per kilowatt of energy supplied to the lamps?—F. L. D., Waukegan, Ill.

Quite a large number of articles on sterilizing water with ultra-violet rays produced by the mercury-vapor quartz-tube lamp have been published during the past few years. The most recent are those by Max von Recklinghausen, one of the originators of the process. These articles from which the data given below were taken appeared in the following periodicals: *Scientific American*, July 19, 1913; *Electrical World*, July 26, 1913; *Engineering Record*, August 2, 1913. According to von Recklinghausen the treatment of water on a large scale with ultra-violet rays generally requires preliminary clarification by means of filters. This is to remove suspended matter which would otherwise reduce the specific transparency of the water and prevent the rays reaching the bacteria. It is said that filtration at from three to ten times the rate of normal biological sand filtration for the same water is sufficient to remove all suspended matter. A number of ultra-violet-ray sterilization plants are now in use in Europe. One of these, situated at Maromme-les-Rouen, has been in operation for two and a half years and gives constantly sterile water. The water is sand filtered at the rate of about 50 feet per 24 hours, and then passed through the rays of a one horsepower lamp at the rate of 130,000 gallons per day. No statement of the condition of the water before treatment is given. The latest type of lamp for the purpose, called a "pistol" lamp because of its shape, is very efficient as it allows practically all the rays to be used where the earlier types utilized only about 60 per cent of the light. It has a U-shaped tube and operates on 500 volts and takes three amperes. The new lamp is said to produce about ten times as much ultra-violet light as the old 220-volt lamp though the wattage is only four times as great. For large plants a multiple unit is used. It consists of a canal, of 50 by 70 inches cross section, through which the water flows and through the walls of which 10 or 12 of the 500-volt lamps are inserted. Glass baffle plates are placed at intervals to keep the water stirred up, and an electric valve held open by the current used by the lamps prevents the passage of water when the lamps are not operating. A canal of this type, which has been in operation for eight months, has 12 lamps and the water passes at the rate of 1,700,000 gallons per 24 hours. At a smaller plant two 500-volt three-ampere lamps are used and the water passes at the rate of 440,000 gallons per day. In the latter case the bacterial count is reduced from an average of 197 to an average of 2.5 by the treatment. In a small apparatus designed for domestic use a 110-volt lamp is used which takes two amperes and the water is sterilized at the rate of 20 gallons per hour. The best efficiency shown by the above data is therefore for the 440,000-gallon plant, where the rate of treatment is approximately 6,000 gallons per kilowatt-hour.—F. E. V., Madison, Wis.

No. 173.—Control of Mercury-Arc Rectifier.—Can a mercury-arc rectifier be controlled to give a constant current otherwise than by the use of a constant-current transformer on the supply side?—S. G. P., Erie, Pa.

There art two classes of mercury-arc rectifiers, the high-voltage kind for series arc lighting and the low-voltage kind used for charging storage batteries. If the first kind is meant, there is no better means of obtaining a constant current than that of using the constant-current transformer. This method has always been used for this purpose, although there is no reason why a constant-current regulator in series with a constant-potential transformer could not be used. The constant-current regulator is nothing but a choke coil capable of automatically varying its reactance. In appearance it is like the constant-current transformer. If the regulation referred to the low-voltage rectifier, such as is used to charge storage batteries, a constant current is obtained by an ammeter contact energizing a step-up relay which cuts in more turns of the compensating reactance. Another way would be to have the step mechanism cut out more resistance which would be in series with the battery on charge. The Electric Products Company, of Cleveland, O., is the only company to my knowledge making this latter type of mercury-arc rectifier and full information may be obtained by addressing that company.—R. L. L., Minneapolis, Minn.

Electrification in Switzerland.

It is considered probable that within the next few years all of the railways that are still operated by steam locomotives in Switzerland will be electrified.

ILLUMINATING A DRAFTING ROOM.

By J. A. Hoeveler and Hugh D. Butler.

In Fig. 2 is shown the floor plan of a drafting room, in which some 40 draftsmen are accommodated. The problem before the writers was to satisfactorily illuminate this room with an overhead system of general illumination. The usual method of the past, of using individual desk lamps, was not considered desirable for reasons which will be evident later.

The conditions to be satisfied in the illumination of a drafting room are somewhat more exacting than those ordinarily encountered in the illumination of interiors.

Fig. 1.—Night View of Drafting Room.

Required Illumination.—The first consideration is the intensity of illumination required on the plane of the tables. Merely to provide a superabundance of illumination is not a satisfactory solution of the problem. Drafting under the best of conditions requires a constant and exacting use of the eyes. Hence, it is very important to protect the eyes as much as possible by properly gauging the quantity of light flux to the correct amount required for the work.

The intensity of illumination must be determined largely by experience. It seems to be the consensus of opinion among authorities that from 5.5 to 8 foot-candles is sufficient illumination for the most exacting drafting work.

Elimination of Shadows.—The second consideration is the elimination of shadows. Sharply defined shadows are very trying and cause no end of trouble to a draftsman. The shadows cast by the edge of his T-square or triangle make the exact setting of either instrument hard and interfere with accurate work. When tracing, the presence of these shadows may cause the tracer to put in a line that will ruin a drawing which represents hours of work, or at least will require laborious erasing.

A very diffuse illumination must be secured in order to sufficiently soften and lighten shadows.

At the present time, the practical and most economical means of producing a highly diffuse and uniform illumination is accomplished by making the entire ceiling of the interior the luminous source. Indirect illumination is based on this principle. Tungsten lamps, equipped with reflectors properly designed for the purpose, are suspended in suitable receptacles from the ceiling, as shown in Fig. 1. The light flux from the lamp is directed to the ceiling by these reflectors, making the ceiling the virtual light source.

In order that maximum diffusion of illumination may be obtained, the ceiling should be as nearly a perfectly diffusely reflecting surface, and as nearly uniformly luminous, as possible. For best efficiency, it should be tinted a white or light cream.

Elimination of Specular Reflection.—The third consideration is the elimination of specular reflection.

The glare of specular reflection from the drawing paper or tracing cloth, where there is a preponderance of light from one direction, is very objectionable and causes a conscious straining of the eyes in the attempt to see. In drafting work, conditions are such that it is impossible to avoid this glare, inasmuch as the drawing board is practically fixed in position. Without doubt, for this reason, this form of glare is much more annoying than the glare from exposed lamps, of which so much has been said.

Absence of specular sources of illumination results in a practical elimination of this form of glare. For this reason then, indirect illumination is best suited to meet this requirement also.

Uniformity of Illumination.—The fourth consideration is good uniformity of illumination on the plane of the tables. In a certain measure non-uniform illumination causes the draftsmen annoyance and trouble. It is usually practically impossible for him to shift his board so that he must frequently move his portable lamp, or work under a handicap on certain portions of his work, if the illumination is very non-uniform.

Uniform illumination is closely associated with highly diffuse illumination, and the methods employed in obtaining the latter usually produce very uniform illumination. Hence, with indirect lighting, the illumination is uniform, provided the installation is designed for a high degree of diffusion.

In accordance with these ideas, the drafting room, Fig. 2, was equipped with 28 units of the type shown in Fig. 1. Each unit is equipped with a 250-watt tungsten lamp, and a silver-mirror reflector having a light-distribution curve as shown in Fig. 4. The ceiling and

walls down to the dado line are finished in a very light cream. Below dado they are finished in a dark buff. The number and spacing of the units is so proportioned that the entire ceiling is luminous. Where units are placed adjacent to skylights, curtains are provided, which are drawn when the units are in operation.

With ceilings as low as the one under consideration (10 feet 6 inches), it is impossible to completely eliminate the intensified area immediately above the reflector, Fig. 1. However, the luminosity of this area is not greater than 0.36 lumens per square inch, which is not excessive. With higher ceilings it is possible to suspend the units at such heights that the flux of light from adjacent lamps overlaps, and an apparently uniform ceiling luminosity is obtained. How much this would add to the diffuseness of the resulting illumination it is hard to say, since the results obtained from the arrangement and suspension height used in this room seem ideal, as will be brought out later.

The area illuminated by these 28 250-watt units is 2,366 square feet; hence, the gross allowance in wattage is 2.96 watts per square foot. It was calculated that this installation would deliver eight foot-candles average illumination on the plane of the tables, making the apparent gross efficiency 2.7 lumens per watt. Since the installation has been in operation the wattage of units at outlets 5, 6, 7, 8, 15, 17, 21, 26, 27 and 28 has been reduced to 150 watts. This reduction was made in locations at which a lower intensity of illumination was found adequate for the particular work carried on. This reduces the gross wattage allowance to about 2.5 watts per square foot.

An illuminometer test was made in the south half of the room, with units 1 to 10 inclusive in operation. The arrangement of tables and stations at which tests were made are shown on the plan, Fig. 2. The reflectors and lamps had been cleaned just previous to making the test and it was noted that the lamps had been operated about three-fourths of their normal life. Readings of the voltage at the cut-out box were taken simultaneously with the photometer readings, in order that any violent voltage fluctuations might be noted, and any apparent discrepancies in readings properly accounted for. The foot-candle readings (horizontal illumination) as measured at the various test stations are given in Table 1. No correction for voltage has been made, since it was impossible under the conditions to measure the socket voltage or even approximate it closely. The reduced values at stations 10, 11 and 12 show the influence of the substitution of 150-watt lamps at outlets 5, 6, 7 and 8. At stations 13, 14 and 15, a reduced illumination is to be expected, inasmuch as at these stations we do not get the combined effect of as many units as at the stations between units. From the test results it will be seen that the illumination over any table is very uniform, and it is safe to say that if all 250-watt units were in use the uniformity over the entire room would be very good. Reductions in intensity are so gradual where 150-watt lamps have been installed, as to be barely noticeable to the naked eye. Hence any one individual working in a given place is not subject to widely differing intensities.

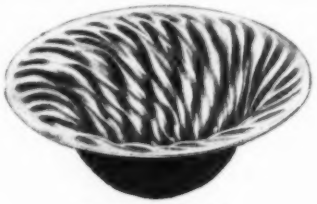


Fig. 3.—Reflector.

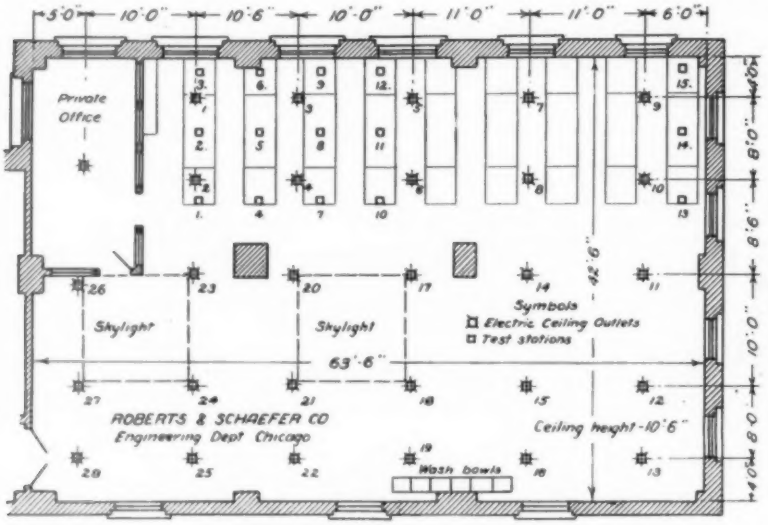


Fig. 2.—Plan of Drafting Room.

TABLE I.

Station.	Horizontal Illumination in Foot-candles	Voltage at Cut-out Box.
1	7.73	113
2	9.20	113
3	7.17	112
4	8.03	113
5	8.80	113
6	7.73	112
7	6.40	113
8	8.63	114
9	6.90	113
10	5.27	113
11	6.73	112
12	4.80	113
13	4.73	113
14	5.87	113
15	4.85	113

Test plane 36 in. above floor. Lamps used: Six 250-watt tungsten lamps and four 150-watt tungsten lamps; voltage rating, 115 volts.

This installation has been in operation slightly more than six months. The men working in the room claim the intensity of illumination on the tables is adequate for all purposes; hence it is probably safe to say that from five to eight foot-candles is sufficient illumination for most drafting work. By a careful study of the requirements for the various classes of work carried on in a drafting room, the size and location of the units may be so adjusted that high intensity of illumination is produced where needed and lower intensity at other points.

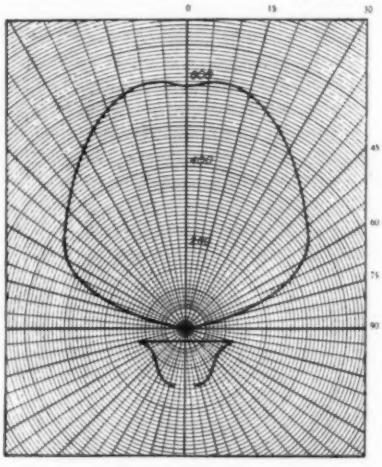


Fig. 4.—Distribution Curve.

The illumination in this drafting room, resulting from these indirect units, is highly diffuse. Shaded areas on the plane of the tables are very light and blend so gradually into the brighter areas as to be hardly noticeable. The flat or blunt end of a pencil placed perpendicular to the table will cast an almost imperceptible small shaded area close to and concentric with its base. A triangle may be placed in any position on the board and there is only the slightest suggestion of a shaded area cast by it. It is possible to draw in any position without reference to the position of the light units without experiencing any difficulty

due to shadows. Because of the highly diffuse source of illumination, and the total absence of specular sources of illumination, specular reflection from tracing cloth, paper and ink is practically absent.

All of these factors, combined with the total absence of high-brilliancy light sources, make the illumination most comfortable. From the practical standpoint an installation such as described has many advantages. Since every square foot of working area is adequately illuminated, the arrangement of the office furniture may be changed at will, without any changes in the location of the lighting units. All of the units are overhead and out of the way. The particular units used in this installation have detachable supporting arms so that one arm may be detached, permitting the reflector to swing free from the lamp when cleaning the unit. The lamp and reflector need not be removed from the fixture for cleaning purposes.

Now compare the above type of installation with the usual drafting room installation employing individual desk lamps. Such installations are characterized by a profusion of unsightly drop cords or flexible-arm desk lamps equipped with metal or paper shades. Frequently the illumination is non-uniform, ranging from a high maximum directly under the light to a minimum at the edges of the table. There are sharp shadows, streaks and striations from the lamp filament, and specular reflection. The maintenance on such equipment is high. One particular case has come to the attention of the writers in which repairs alone (excluding lamp renewals) on 29 desk lamps exceeded $50.00 in a year.

For these reasons it would seem that an overhead system of general illumination of the indirect type is by far the preferable method of illuminating a drafting room.

White Way in Little Falls.

The inauguration of a "White Way" in Little Falls, Minn., was celebrated on October 25. Bad weather interfered with the parade, Home-Coming Celebration and a program of sports, but did not interfere with a meeting in the Victor Theater, which was addressed by Governor Eberhart, T. C. Gordon, of the Little Falls Water Company, and W. E. Penfield, also representing the company. There were also several other speakers. Governor Eberhart threw the switch which started current through the new lighting units.

The system consists of 108 posts, each carrying a cluster of five tungsten lamps.

The production of coal in Kentucky established a new record in 1912 with a total of 16,490,521 short tons.

MAINTENANCE SERVICE FOR MOTOR USERS.

By G. D. Crain, Jr.

The constantly increasing number of industrial users of electric motors, and the correspondingly large increase in petty repair work which comes to the attention of concerns handling electrical goods, suggests the advisability of some action calculated to eliminate a large percentage of the troubles due to inattention and unskilled tinkering.

An example of the extreme usefulness and practicability of arrangements by which expert care can be secured for balky or broken machinery is given in the numerous automobile service stations which are found on all well traveled roads. It is no longer necessary for the motorist to be a competent mechanic, and he need not even soil his hands and twist his temper in the work of changing a tire. All he has to do is to step to the nearest telephone, and in a few moments a garage service car is on hand, with first aid to the injured machine.

This indicates that there is a large and profitable field for electrical houses in cities where there are many motors in use, to establish a service station which will not only furnish competent men for such repair work as is necessary—work which, of course, is now handled by practically all electrical concerns dealing in motors—but will go as far as possible toward preventing trouble.

A firm of electricians, handling a line of new and second-hand motors in a good-sized Middle-Western city, where there were numerous small manufacturing plants using motor drive, found in its practice that there was frequently trouble with the motors, of a minor nature, caused by lack of oiling; and that sometimes users blamed the motor for some difficulty in reality caused by the machine to which it was connected. Sometimes connections were faulty, causing poor operation, and more than one case was found where careless handling of material had injured insulation.

All of these things, and many others which will readily occur to the man who knows anything about electricity, and has seen the way equipment is frequently handled by the ignorant, were obviously due to the fact that in the plants where they occurred there was no one who knew enough about motors to be entrusted with their care. The net result was that the owners did not get the service they should out of their motors, and that, in consequence, dissatisfaction with electric drive always resulted.

This, of course, was not a good thing, either for the men whose business it was to sell motors, or for the central station whose business it was to supply current. With these things in view, and with an eye as well to the profit to be gained directly, the firm devised a service plan which it was convinced would be acceptable to the average small user of electric motors.

The proposition was to take over the work of maintaining the motors for all industrial concerns which cared to enter into the arrangement, sending a man around regularly—once a week was the plan at the outset—to clean, oil, and generally overhaul the motor equipment, and keep it in good running condition. Of course none of the concerns large enough to employ an electrician of their own were approached on the proposition, because they were obviously not likely to be interested.

The charge made was three dollars a month, which included any repairs necessary to the motors for any reason, as well as the regular inspection. The flat charge for all repair work operated, logically, as a guarantee to those taking the service that their motors would be kept in the best possible shape, because it was to the interest of the electrical firm to have as little repair work to do as possible; and this point was the clincher which brought many over to taking the service.

"The greatest trouble with the motor used by the average relatively small concern is dirt," said a member of the firm, with reference to this branch of the business. "Many users expect them to run indefinitely without any attention at all; and while motors will frequently give perfect satisfaction for several years without any attention being given to them, it certainly is not the best way to treat them.

"We found it easy enough to convince most of those whom we approached with reference to the service proposition that their motors would be the better for a little regular expert attention; and as they were not in a position to give this expert attention themselves, it was natural to turn this care and supervision over to us. A good man with an oil can and a few tools in a bag makes the rounds weekly, doing whatever is necessary, and frequently saving much trouble, by locating a factor which may cause a breakdown, and fixing things up before they have gone to the bad.

"Of course, a good mechanic could do most of the work which we do, under the contracts which we have en-

tered into with a number of concerns around town; but he would very frequently be at sea on a very simple point, necessitating expert assistance, at an expense much greater than our regular charge for general maintenance. Thus our service is a real economy to the concerns using it, besides being an illustration of the ounce of prevention which obviates the necessity for the pound of cure."

It should be observed, however, that this firm does not guarantee the motors themselves, nor will it, under its maintenance agreements, rebuild a motor. All that it does is to see that the motor is kept running in good shape as long as it is fundamentally capable of doing good work. When the motor wears out, the responsibility of the firm ceases. Advice is given to the owner according to the situation, and the firm usually sells a new motor.

In this respect, it profited from the example of a predecessor in the same line of business, who had gone considerably too far in his efforts to land the business. He came into the field without the prestige of having been previously engaged in handling electrical work and supplies in the city, and started his maintenance shop purely on his conviction that it was a good thing both for himself and for motor users.

In this he was correct; but his enthusiasm led him into the error of promising too much, and in the end this caused his failure. Instead of specifically confining himself to a contract to supervise and care for motors, taking care of the necessary incidental repairs, he practically guaranteed that the motor would never wear out, which, of course, was going rather too far. When an armature burnt out, or when brushes had to be replaced, his customers called upon him, under his too generous contract, to make good; and in doing so he found that his profits rapidly disappeared.

New parts, and major repairs, necessitated by wear, should of course not be supplied by any electrician handling motors under a maintenance agreement, because no maintenance charge could be made sufficient to cover these things—none, that is, that would be paid by any manufacturer or other user of motors.

There is a legitimate field for the kind of work indicated, however, in every city of any size, and this field will enlarge as the use of motors grows. Scores, and even hundreds, of small manufacturers in the downtown districts of most cities are using motors, as the most economical and convenient method of getting power; and as few of these are themselves competent to take care of their power equipment, the service station of the electric shop can step in to good profit.

One concern in New York City keeps a large force of men profitably employed in just one branch of this kind of service—looking after the electrical equipment of printing shops. The company handles printing machinery as well as motors, and its service arrangement with the owners of the shops tends to keep both kinds of equipment working at full efficiency.

Possibly the most important field, however, is that made up of manufacturers who have changed from steam to electric drive. One of the chief economies effected by this arrangement is the elimination of power-plant employees. The user of electric current who has been accustomed to paying a fair salary for the work needed to keep his steam plant up to the mark, believes that his electric motors will run without attention of any kind.

The result of this lack of attention, or attention by those who are not qualified to give it, is usually unsatisfactory. The complaint of poor service reaches the central station, or it may reach the concern which sold the motors. The necessity for the complaint is eliminated when the user of central-station service substitutes for the engineer who was on the job all the time the occasional services of a concern which is prepared to keep his equipment in good shape.

Such an arrangement helps everybody. It pleases the user; it helps the central station, and it is profitable for the motor concern which operates it.

Instability of Electric Circuits.

At the first joint meeting of this season of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, which was held on the evening of October 29 in the Art Institute, Chicago, Charles P. Steinmetz delivered a lecture entitled "Instability of Electric Circuits." The meeting was opened by R. F. Schuchardt, who asked Louis A. Ferguson to introduce the speaker. In doing so, Mr. Ferguson spoke of the varied accomplishments of Dr. Steinmetz and called attention to his many-sided interests.

Dr. Steinmetz opened his lecture by referring to the early days of electrical engineering when practically all theoretical investigations were limited to circuits of stable or stationary condition. In those days it was a source of gratification when one could calculate the stable phenomena. The first study made of unstable circuits was in regard to transients. The conditions producing instability were practically unknown and even to this day many features thereof have remained unsolved. The lecturer took up three classes of unstable conditions in circuits.

The first of these related to transient phenomena, which are associated with the readjustment of a circuit to changed conditions. These are always due to a sudden change in a circuit; for instance, if a switch is suddenly closed and thereby a load placed on the circuit, the current cannot instantaneously increase to the value corresponding to the increased load, but some time must elapse during which the increase of stored magnetic energy corresponding to the increased current is brought about; similarly, if a motor switch is closed, a period of acceleration must intervene before the flow of current becomes steady. Therefore, transients are all of limited, and usually very short, duration intervening between two periods of stationary conditions. That investigation which has been made of transients has concerned itself chiefly with circuits in which the electrical constants (resistance, inductance capacity, etc.) are assumed fixed. However, in actual circuits, there is usually produced an additional difficulty due to more or less variation of these constants which produce secondary phenomena and have as yet been studied only to a limited extent. The oscillations frequently produced during the transient change usually die out at a faster rate than is expected from equations, because the constants are not the same at high frequencies as normally. Moreover, the conditions under which the attenuation constant of the transient becomes zero or negative and thereby the transient becomes permanent or even a cumulative effect, are not well known.

The next class of unstable conditions considered by Dr. Steinmetz was that of unstable electrical equilibrium. If the effect brought about by a cause is such as to oppose or reduce the cause, the effect must limit itself and stability be finally attained. If, however, the effect brought about by a cause increases the cause, the effect continues with increasing intensity and instability results. These truths apply not only to electrical but also to all other phenomena of instability. Thus a motor with an increase of load slows down. If this decrease of speed increases the driving torque, as it does in the series motor, the diminution of speed stops at that speed at which the the driving torque becomes equal to that required. Such a case is one of rapid attainment of stable conditions. If, however, the decrease of speed in the motor decreases the motor torque (as it does in an induction motor below the maximum-torque point) the decrease of the motor speed causes a still greater difference between the driving torque developed and that required by the load, and therefore a still greater slowing down of the motor; thus with increasing rapidity the motor speed decreases until the motor

stops, this being evidently an illustration of unstable electrical equilibrium.

Probably the most important case of unstable electrical equilibrium is in circuits containing an arc. Since the voltage consumed by an arc decreases with an increase of current, if that arc is supplied from a constant-voltage circuit there must be resistance in series and there are usually two current values at which the arc can operate. One is stable. Other current values produce unstable conditions until the current can adjust itself to the one stable value or drops to zero.

The third class of unstable circuits is that in which permanent instability results from a combination of circuit constants which cannot co-exist. If any of these constants such as capacity, disruptive strength, impressed voltage, etc., have values that cannot co-exist, the circuit becomes unstable and remains so as long as the constants remain unchanged. This instability usually produces phenomena which are more or less periodic or intermittent. Dr. Steinmetz gave an illustration of this type of instability by considering a transmission line which has a punctured insulator resulting in an arcing ground. The discharge through the puncture grounds the line and consequently the potential difference between that side of the line and ground practically vanishes, so that the arc soon dies out. The voltage immediately rises again, however, until the striking point is again reached, when another arc starts, the cycle repeating itself indefinitely. A condition may also exist in which such a circuit may have two permanent conditions, one of stability and one of instability; as long as the voltage is gradually applied the conditions are stable; if, however, an excess voltage is applied sufficient to start a discharge through the punctured point the unstable condition of the circuit continues as an intermittent arc indefinitely.

The most interesting group of permanently unstable circuits are the oscillations sometimes resulting from a change of circuit conditions, such as switching, change of load, etc., which continue indefinitely with constant intensity, or which even increases steadily in intensity and may thus be regarded as permanent or cumulative surges; the phenomenon of hunting is a good illustration of this. Such oscillations may be considered to be transients in which the attenuation constant is zero or negative. If the oscillation produced by a change in circuit conditions is accompanied by a gradual dissipation of the energy existing in the circuit before and after the change that has produced the oscillation, then that oscillation gradually dies out. But if that oscillation itself produces an energy supply to the oscillating circuit, then the oscillation may continue indefinitely of constant intensity or even increase. If this energy supply is equal to the energy dissipation constancy of the phenomenon results; if the energy supply is greater than the energy dissipation the oscillation becomes cumulative and steadily increases until self destruction of the system results, or until the increasing energy loss becomes equal to the energy supplied, in which latter case the stationary condition of oscillation is produced. The exact conditions of this type of instability are as yet unknown. Cumulative oscillations between the electromagnetic and electrostatic energy of a circuit have frequently been observed by their effects in high-voltage circuits and transformers and other apparatus, and in some cases these have been recorded on the oscillograph. They are the most dangerous phenomenon in high-voltage circuits. Little exact knowledge exists of their origin; usually, however, an arc somewhere in the system is instrumental in the energy supply which maintains the oscillation. In some instances they have found industrial application, as in wireless telegraphy.

One of the best examples of this type of permanent or cumulative oscillations is that of hunting in synchronous machines. The lecturer gave an analysis of the hunting of a synchronous motor. In this machine the torque depends not upon the speed, which is fixed by the frequency of the applied voltage, but upon the position of the rotor relative to the rotating magnetic field—that is, upon the lag. An increase in load of such a motor causes a slight retardation of the rotor. When it reaches the new position of equilibrium, its speed is below synchronism and hence it falls behind its normal position of exact equilibrium. The synchronizing force of the machine then causes the rotor to accelerate to somewhat beyond its normal position, and consequently there is produced a series of oscillations which usually die down on account of the energy losses caused thereby. If, however, the cause which brings the rotor back from a position ahead or behind its normal position is greater than the torque which opposes the deviation of the rotor from its normal position, each swing tends to exceed the preceding one in amplitude and, if the energy losses thereby produced are insufficient, the oscillation thus increases and becomes cumulative, producing the condition commonly known as hunting. Dr. Steinmetz showed how the damping winding consumes part or all of the energy set up in the oscillations and thus causes the latter to gradually decrease. The condition for stability of the synchronous machine is that the average damping power should exceed the average synchronizing power, and the greater this excess the more stable is the machine and the more rapidly does the transient oscillation of readjustment to changed circuit conditions die out.

POWER CONDITIONS IN THE NORTHWEST.

By W. E. Herring.[1]

Much has been written as to the millions of undeveloped horsepower on the various streams in the Pacific Northwest. In all of the articles heretofore appearing, no reference has been made to the lack of a market for this power. Without a market for the energy, the finest water-power developments in any section have no economic value. Up to 1910 there had been a rapidly increasing demand for power, which taxed the operating companies to meet. Subsequent to that date the rate of demand has not kept pace with that earlier established, with the result that all of the operating companies in the Northwest find that they have a capacity in excess of that needed, varying from a few thousand kilowatts with some of the companies to a considerably higher figure with some of the others. Unless industries are brought into the Northwest to absorb a portion of the power already developed, it will be some years before the construction of any new power plants will be warranted.

The increase in efficiency of the various electrical machines, the greater distance to which energy can be transmitted, and other advances made in the electrical industry, have all tended to decrease the price paid by the consumer for his energy, and rates all over the country have been constantly decreasing, until those at present in force with the larger companies are only from 35 to 50 per cent of the rates in effect a few years ago. At the present time rates here compare most favorably with those in any other part of the United States. The lighting rate in Seattle of 6 cents per kilowatt-hour for the first 60 kilowatt-hours and 4 cents for all over that amount, with a monthly minimum of 50 cents, is perhaps as low a rate as is obtained in a city of any size in the United States. The rates in Portland, Ore., and Tacoma, Wash., while slightly higher, are about the same as in Seattle. Power rates to large consumers are, perhaps, as low as can now be had at any place in the United States for similar service.

The states of Washington and Oregon are divided roughly into two parts by the Cascade range of mountains, which has an average elevation of 4,000 to 6,000 feet, with peaks in it ranging as high as 14,000 feet. The two portions of the two states are entirely dissimilar in character, the west side being in a moist climate with

1 Industrial agent, Puget Sound Traction, Light & Power Company.

very mild winters and comparatively cool summers, while on the east side the very opposite condition exists, it being more of a desert country—hot and dry in summer and cold in the winter. Naturally, there is a marked difference in the precipitation, it varying from 10 inches per annum on the east side to as high as 120 inches per annum on the west side.

It is generally conceded that the streams on the west side of the Cascade Mountains, in both Oregon and Washington, present unusually favorable conditions for water-power developments. They have a rapid fall and abundant water. Their sources mainly being in perpetual ice and snow, it would seem that the stream flow would be comparatively well regulated, yet every operating plant in this territory needs storage to carry it over the two low-water periods which are had on a majority of the streams—one being in February and the other in September or October.

The prevailing opinion among the general public is to the effect that practically all of the streams on the west side have splendid water-power possibilities and that it is only necessary to locate one of them, raise the money to construct a power plant, and then figure some method of expending the supposedly enormous revenue derived from the plant. Operating people know only two well that this is far from the case.

But few people realize the numerous difficulties which need to be overcome in the construction of the average power development. Usually, they are located in remote places, not reached by even a wagon road. With the great quantity of various construction materials needed and the heavy pieces of machinery which are installed in the power plants, it is almost a necessity to have a railroad to the site. The length of the road, of course, varies with conditions. One plant which is now under construction in the Pacific Coast section necessitated the building of 56 miles of standard-gauge railroad before any construction work was started on the power development. The materials which need to be transported include, among other things, tons upon tons of steel for the construction of the pressure pipe, in the concrete reinforcement and other uses in connection with the work; machinery and other equipment weighing hundreds of tons, generating equipment for a temporary plant used during construction, air compressors, head gates, water wheels, generators, and the other incidental machinery required in the power house; the transportation of an immense quantity of powder, cement, food and other supplies and material necessarily needed in the construction of a great work of this kind.

In addition to the power plant, there is needed, first, a transmission line to conduct the energy from the point at which it is generated to the market. This distance varies in each individual case. At a plant which is now under construction in the western country, the length of the transmission line will be 240 miles, one of the longest in the world, and the transmission voltage will be 110,000. The supports for the conductor on this line, instead of being the usual wooden poles with cross-arms, will be steel towers built on the ground and having a maximum spacing of approximately 800 feet. Such a line presents unusual difficulties in construction, which necessarily increases its cost. Even with the ordinary transmission line of wooden poles spaced approximately 150 feet apart, there are many difficulties to overcome. Clearing of the line in itself, in a heavily timbered section, entails a heavy expenditure. All trees on each side of the line which might strike the line if they should fall, need to be cut to prevent an interruption to the service. This means in the Northwest, that a very wide strip needs to be cleared, since the height of some of the trees is more than 250 feet with an average of perhaps 150 feet. Contrary to the usual supposition, poles for the transmission line often need to be hauled many miles, although there may be abundant timber adjoining the line. Cedar is the wood most generally used, on account of its lasting qualities, and if it cannot be obtained locally, is often shipped in. The insulators for the ordinary 60,000-volt transmission line are 18 inches in diameter at the bottom and weigh 27 pounds each. They do not, from the ground, appear to be this size, neither would one think they were so much larger or heavier than the ordinary glass or porcelain telephone insulators, which weigh less than two pounds. The various camps sheltering the men who are employed in the clearing of the line, digging the holes, erecting the poles and stringing the wire, must all be supplied with food and the various material and equipment needed in their work, and in sections of the country lacking wagon roads the problem presented is a very difficult one. Construction of many miles of wagon road is imperative, and the amount of work involved in maintaining them during bad weather for the passage of heavily laden teams is a big task. The average cost for a high-tension line in heavily timbered country using wooden poles, is $4,000 per mile, while if steel towers are used, it is more.

At the market end of the transmission line is a substation, into which the energy from the power house is conducted at the high-tension voltage and reduced to a lower voltage for distributing purposes. Several lines may reach from this substation to other substations located in various parts of a city and from which substations the distributing system radiates to all sections of the city. The equipment in the substation consists of intricate and expensive machinery, again increasing the total cost of the work. The distributing system itself in the ordinary city, costs from $8,000 per mile in the overhead district where poles are used, to as high as $40,000 per mile for a six-duct lead in the underground section.

It will thus be seen that there are many things to be considered in addition to the power site itself. Further, when plans are being made for the development of any particular project, it is necessary to bear in mind one essential feature in this business, that is, continuity of service. In order to more thoroughly guarantee this, it is always necessary to have a steam auxiliary plant, if only one power development is owned. The steam plant is often used also to carry part of the load during the peak, and by all of the larger companies a steam plant is always had as a standby in order to more fully protect their consumers. In addition, storage batteries are usually supplied with a capacity sufficient to carry the entire load of the system for a length of time sufficient to allow the steam plant to be cut in. In Seattle the operating company has $270,000 invested in such batteries, which will carry their load for 25 minutes only. Under such conditions, if an interruption is had for any reason, such, for instance, as a lightning storm, the storage batteries can immediately be cut in and no interruption of service occur. Since fires are kept under the boilers in the steam plants night and day, it requires but a short time to get up sufficient steam to take on the load.

Briefly, these are a few of the difficulties which need to be met and solved by all operating power companies. After a system is constructed there are many causes of trouble, all of which need to be constantly looked after and carefully and quickly repaired. Everyone is familiar with the trouble which occurs during an exceedingly heavy wind storm, lightning storm, or a heavy sleet or snow storm, but few people realize, however, the immense amount of trouble and expense such a storm means to the power companies. Miles of distributing system may be put out of commission, poles blown over or broken off,

wires snapped, insulators broken, and such havoc wrought in a few minutes as requires many thousands of dollars to repair, and much time to recover from the effects. During such accidents, the advantage of having more than one transmission line, or of being able to get energy from more than one plant, is readily realized. If two or more plants are operated by the same company, each having its own transmission lines, there is much less danger of an interruption to the service. This is one great advantage of plants being coupled up.

There is a loss of power from the power site to the consumer, of approximately 50 per cent. In other words, of each horsepower available at the power site, only one-half horsepower eventually reaches the consumer, or about 70 per cent of that generated. The losses are experienced in the water wheels, generators, transformers, transmission line and distributing systems.

Contrary also to public opinion is the fact that the initial cost of a complete water-power development is from two to four times the cost of a steam plant of the same capacity.

The light and power business in the western portion of the two states of Washington and Oregon is now done by several different companies. The Puget Sound Traction, Light & Power Company has four operating power plants and six steam plants in the Puget Sound region, and supply the entire territory from Tacoma north to the British Columbia line with energy. Their total rated capacity is 105,440 horsepower, of which 75,667 horsepower is in the water-power plants. This company is under the management of Stone and Webster.

From Tacoma south to the Columbia River, the southern border of Washington, a distance of approximately 125 miles, there are several small cities, all supplied by the Oregon-Washington Corporation with energy, which at present is supplied from two steam plants and one small water-power plant. The total rated capacity is 3,087 horsepower, of which 887 horsepower is in the water-power plants.

The Pacific Power & Light Company supplies a number of cities and towns from Hood River on the Columbia River east, practically all of them east of the Cascade Range.

The section from the Columbia River south to Salem, including Portland, Ore., approximately 50 miles, is supplied by the Portland Railway, Light & Power Company from three water-power developments and seven steam plants, with a total rated capacity of 81,267 horsepower, of which 55,307 horsepower is in hydroelectric plants. A new company which has recently entered the Portland field is the Northwest Electric Company with a hydroelectric plant in the state of Washington of 16,000 horsepower rated capacity, and a steam plant under construction in Portland, of 5,000 horsepower capacity.

From Salem south to and including Eugene, Ore., approximately 70 miles, the Oregon Power Company, owned by the H. M. Byllesby Company, furnishes all energy from two steam plants and one water-power plant, with a total installation of 5,616 horsepower, of which 666 horsepower is in the water-power plant.

The country from Eugene to Grant's Pass, Ore., a distance by rail of approximately 175 miles, is served by several small isolated central stations. The California-Oregon Power Company supplies the territory from Grant's Pass to the California line, a distance of about 50 miles, included in which is Medford, the largest city in Southern Oregon. This company has in Oregon three water-power developments, two of which have a capacity of 8,300 horsepower, and two water-power plants in the northern portion of California.

From the above it will be noted that the largest operating companies in this section find it necessary to have large steam auxiliary plants, entailing an additional heavy financial burden, to carry them over the peak loads, and to practically guarantee uninterrupted service.

The water-power plants already developed by the operating companies comprise, naturally, those sites nearest to a market, but do not include some of the better developments which are still available, although a greater distance from the existing markets. Under present conditions of transmission, the greater distance from market would entail but a slightly greater loss, perhaps two or three per cent only, in reaching the market with the energy, than is now had from existing plants.

Notwithstanding the fact that the general idea is that there are no sites available for new developments, some of the very best possible developments, from purely the standpoint of cost of plant, have not been carefully investigated, for the simple reason that no market exists for the power. These powers are on some of the largest rivers in the two states and where the fall in the streams is particularly rapid. Contrary also, to the usual notion in regard to these projects, they are not owned or controlled by any corporation, and many of them can be filed upon by any one who chooses to do so. The interests now in the field do not want such projects for they could make no use of them.

Scarcely a week passes that does not bring to the larger companies at least one offer to sell a power site, but under present market conditions, it will be years before any interest can be manifested in these propositions. The larger companies recognize this situation, and since anything that will tend to build up the country in which they are operating will redound to their advantage, it is policy for them to assist in every material way in the upbuilding of this section. One company, at least, in the Northwest, has been cognizant of this situation and has instituted an aggressive campaign to secure additional industrial enterprises. Such a campaign is a new departure in this line of work, but it is realized that if the country is to be more fully developed, that additional manufacturing enterprises must be secured, and particularly is this true when the raw materials, markets and labor are already present. They are carrying on this campaign individually, but are co-operating in every consistent way with the various commercial bodies, and the results obtained will be of much interest to other concerns similarly situated. Extremely low rates for power are being offered as a special inducement for new enterprises. Rates less than $20.00 per horsepower-year for 24-hour power have been quoted to prospective users of large blocks of power.

The power cost of manufacturing per month, assuming a use of 100 horsepower 10 hours per day, with a load factor of 75 per cent, in various cities, is approximately as follows:

Boston	$937.50
Philadelphia	839.25
New York	699.37
Chicago	629.43
Cleveland	559.50
Pittsburgh	417.62
Buffalo	184.91
Seattle and vicinity	$150.00 to 375.00
Niagara Falls	144.17

The Seattle rate depends upon the amount of power used and the location of the consumer with relation to the generating station.

Power, of course, is but one, and perhaps the least, with a few exceptions, of the four essentials which are needed to build up a manufacturing community. First, are the raw materials; second, the markets, including transportation; third, the labor; and fourth, the power. The conditions existing in this section are materially different from those in the eastern part of the country, where, with a dense population, practically an unlimited market, resulting in numerous and

diversified industries, the demand for power is extremely heavy, and, as a result, streams with but a light fall have been harnessed to supply the needs. Low-head developments are the rule rather than the exception, while in the Northwest there are no low-head developments and practically no attention has been paid to even the larger streams where such developments could easily be obtained.

It is granted that there are unlimited power possibilities on the various streams in the states of Washington and Oregon, but at the same time it must be remembered that until the country is more densely populated and there are more industrial plants located here, there will be no such development of these streams as has taken place in other parts of the United States.

Electric-Vehicle Exhibit in Boston.

At a meeting of the Electric Motor Car Club of Boston, held Monday noon, November 3, at the Edison Company's building in that city, plans for an exhibition of electric passenger automobiles were outlined and committees announced who will carry out the project. The affair will be one of the most ambitious ever undertaken in electric-vehicle promotion. The aim is to make it a notable society event, to the end that the electric motor car will come to have a distinct vogue such as the "society evenings" of the Boston Automobile Show, held in early spring, attempt to give all cars of the more luxurious type.

The "Electric Automobile Salon," as it will be called, is to be held in Boston's foremost and newest hotel, the Copley-Plaza, on November 17, 18 and 19. The elegant ball-room of the hotel will be given over to the exhibit, to which an admission price of one dollar will be charged. There will be musical features of a high order. The latest models of every make of electric passenger car represented in Boston will be on exhibition. These include the Bailey, Baker, Detroit, Columbus, Church-Field, Ohio, Standard, Rauch and Lang, Waverley, and Woods. No trucks will be exhibited, but agents for trucks will coöperate in this show. It is expected that an exhibition of electric trucks will be held later in the season. Battery manufacturers will exhibit.

The show will be open from 10 a. m. to 11 p. m. Engraved tickets of admission will be distributed among agents and owners for the use of prospective customers. A letter will be sent to central-station men in New England, inclosing literature on the subject of the electric vehicle and the show, to be distributed among interested people in the various localities.

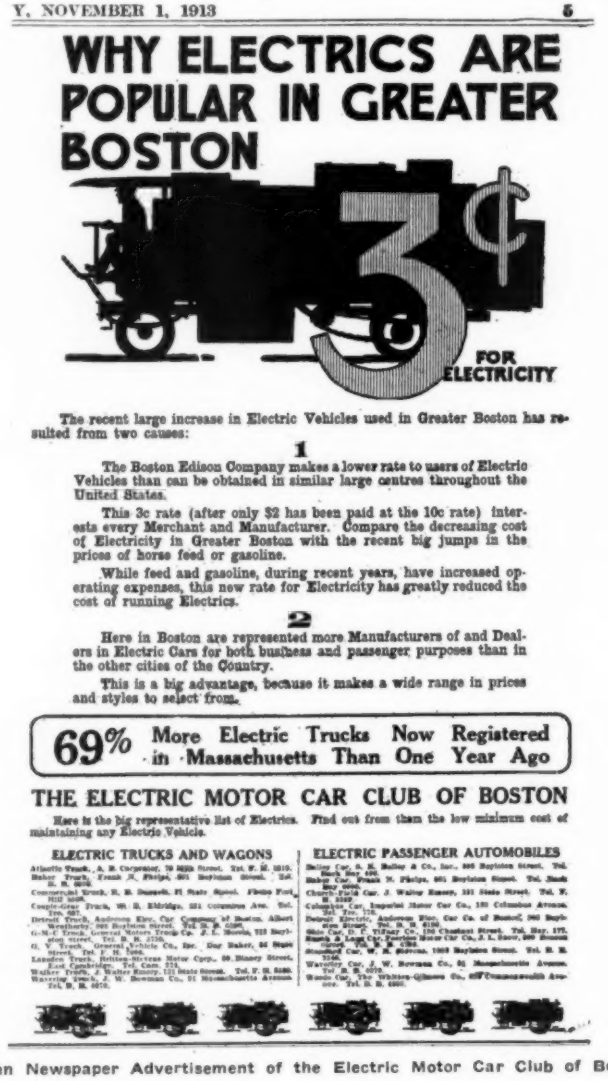
The following committees, supervised by Herbert W. Moses, of the Boston Edison Company, who managed the last Boston Electric Show, will have charge of the exhibition.

Exhibits: W. H. Francis, John L. Snow, Albert Weatherby, D. C. Tiffany, E. A. Gilmore and J. W. Bowman. Advertising and Publicity: Albert Weatherby, C. D. Marsh, Day Baker, D. C. Tiffany, L. D. Gibbs. Reception: C. J. Hatch, L. L. Edgar, L. R. Vredenburg, F. B. Carter, F. J. Stone, Dearborn Bailey. This committee will also include several central-station men, to be chosen later. Printing: Albert Weatherby, Day Baker. Finances: J. S. Codman, F. J. Stone, E. S. Mansfield. Music: R. Wallis. Police and Parking: C. S. Smith. Ticket Distribution: O. G. Draper.

The Salon will be under the direction of the Club, and will have the financial backing of the Boston Edison Company.

Quick Connection in Springfield.

A record-breaking installation of electric power for factory use was recently accomplished at Springfield, Mass. On October 20, at 11 a. m., the engine of the Barney & Berry skate factory in that city became disabled through the blowing out of the cylinder head. Prospects were for a protracted shut-down, when it was suggested that an attempt be made to secure immediate electric equipment. The United Electric Light Company was called by telephone and arrangements made for connection with its circuits, and the securing of motors. As a result, within 29 hours, 1,100 feet of underground cable was installed, three 50-horsepower motors secured from the General Electric Company's Schenectady works, and the complete installation effected, ready for operating the factory. It is stated that the prompt change to electric drive saved the company a large sum of money.


Y, NOVEMBER 1, 1913 5
WHY ELECTRICS ARE POPULAR IN GREATER BOSTON
3¢
FOR ELECTRICITY
The recent large increase in Electric Vehicles used in Greater Boston has resulted from two causes:
1
The Boston Edison Company makes a lower rate to users of Electric Vehicles than can be obtained in similar large centres throughout the United States.
This 3c rate (after only $2 has been paid at the 10c rate) interests every Merchant and Manufacturer. Compare the decreasing cost of Electricity in Greater Boston with the recent big jumps in the prices of horse feed or gasoline.
While feed and gasoline, during recent years, have increased operating expenses, this new rate for Electricity has greatly reduced the cost of running Electrics.
2
Here in Boston are represented more Manufacturers of and Dealers in Electric Cars for both business and passenger purposes than in the other cities of the Country.
This is a big advantage, because it makes a wide range in prices and styles to select from.
69% More Electric Trucks Now Registered in Massachusetts Than One Year Ago
THE ELECTRIC MOTOR CAR CLUB OF BOSTON
Here is the big representative list of Electrics. Find out from them the low minimum cost of maintaining any Electric Vehicle.
ELECTRIC TRUCKS AND WAGONS
ELECTRIC PASSENGER AUTOMOBILES

Specimen Newspaper Advertisement of the Electric Motor Car Club of Boston.

Convention of Railway Commissioners.

The twenty-fifth annual convention of the National Association of Railway Commissioners which has just closed in Washington, may well be considered as one of the best ever held in the history of the organization; more time was given to valuable discussions, more interest was taken in those discussions, and more toleration of the views of others shown, together with a greater desire for uniformity of action. Very many interesting reports were presented.

The officers elected for the ensuing year are J. B. Finn, Kentucky, president; Clifford Thorne, Iowa, first vice-president; Judge Prentiss, Virginia, second vice-president; W. J. Connelly, Interstate Commerce Commission, secretary; and William Kilpatrick, Illinois, assistant secretary. The next meeting will be held in Washington, November 17, 1914.

The question of state and interstate rates, and the jurisdiction over the control of same for all public utilities received considerable attention. In an able paper Mr. Finn said, that the establishment of reasonable intrastate rates may mean the adjustment of an interstate rate should not seem to present an impossible position, any more than would the reverse proposition. There should be no conflict of authority when an intrastate rate overlaps and becomes an interstate one. The jurisdiction of the federal or the state authority can be made to depend upon the lethargy of either one.

A very interesting paper was read by E. B. Rosa, physicist of the Bureau of Standards, in which he touched on the tests which have been made by the Bureau on gas standards, electrolysis of gas and water pipes, telephone and electrical appliances; it is believed that the damage which has been caused by electrolysis can be reduced to a minimum; he also expressed the opinion that the matter can be best managed not by going into the courts, but by hearty co-operation between the electric companies and the various public service commissions. Dr. Rosa suggested the establishment of standards of efficiency to which public utilities would have to measure up when applying for authority to increase their stock and bond issues.

The success of public utility commissions justifies their existence, but this success has only been attained as the result of painstaking work and high effort and ideal. There should be the closest sort of co-operation between the Bureau, the public service commissions, railway commissions and large public utilities.

The Report on Telegraphs and Telephones was presented as follows.

Up to this time no specific method has been adopted generally as a basis for rate-making. Individual plant conditions have governed in nearly all cases and therefore we will treat the subject generally and submit some views together with what comparative statistical information we have been able to secure. That scientific making of rates has not been indulged in to any great extent can be clearly observed through the following comparison of cities, in which are located competitive plants, with cities where there is no competition:

Competition.		Population.
Chicago, Ill.	$84	2,185,283
Philadelphia, Pa.	90	1,549,008
St. Louis, Mo.	78	687,029
Cleveland, O.	72	560,663
Buffalo, N. Y.	72	423,715
Indianapolis, Ind.	54	233,650
Memphis, Tenn.	48	131,105
Decatur, Ill.	30	31,140
Monopoly.		**Population**
New York, N. Y. (Manhattan)	$128	2,331,542
Boston, Mass.	125	670,585
Baltimore, Md.	174	558,485
San Francisco, Cal.	180	416,912
Denver, Colo.	138	213,381
Oakland, Cal.	84	150,174
Burlington, Iowa	72	24,324

The above comparisons raise the following questions: (1) Is competition necessary to secure reasonable rates? (2) Are the rates charged under competitive conditions reasonable or remunerative? (3) What remedy should be suggested?

Without question competition has been the means of the public receiving service at a lower cost, but this does not necessarily mean that the rates are either reasonable or remunerative. Many companies have entered the field of competition with low rates and in a short time found it necessary to get nearer the plane of their competitor, or, in some cases, the competitor has met the lower rate, this nearly always resulting in a consolidation of the two plants within a short period of time. Where competition exists the public is in a state of semi-belief that it is receiving service at as low a rate as it is possible for the companies to render the service. The activity of the competitors in systematic advertising and the soliciting of new business through well trained men all tend to stimulate the ever smoldering fire of public discontent, which, no matter how carefully nursed, breaks forth from time to time, causing renewed activity and in many instances, a reduction in rates by one or the other competitor and in many instances by both. Surely scientific lines are not followed under such conditions.

A remedy for these conditions is being sought by both the public and the utility operators. There can be no question but that duplicate plants in the same city is a waste of money and a public burden.

State control of such utilities offers the best remedy for these conditions. Government control has not proved entirely successful. For example, the Japanese government had on March 31, 1911, 45,000 persons on the waiting list for telephone service; it appropriated $12,000,000 for expansion for the year ending March 31, 1913, and was considering an appropriation of $25,000,000 for the next five years ending March 31, 1918. There are now 28 states exercising control over telephone utilities. However, the work has just begun. The railroads have consumed so much of the time of the various commissions that the telephone situation has been considered, to a large extent, more or less incidental, but, when it is considered that the number of telephone conversations per year outnumber the passengers carried by the railroads over five to one, more consideration should be given the subject. The details of the telephone business are far greater than those of the railroad business and the average commissioner would rather wrestle with ten big railroad cases than one small telephone case.

Interesting figures have been compiled showing the telephone development in 115 cities having a population of over 50,000 as of January 1, 1913. The first fourteen cities are herewith enumerated:

Name of City.	Stations per 100 population.	Estimated population of Exchange area.	Total Stations.
San Francisco ..	23.7	454,000	107,702
Spokane	20.4	105,300	21,411
Omaha	20.1	166,000	33,358
Dallas	19.1	114,700	21,881
Des Moines	16.7	96,000	16,074
Oakland, Cal. ...	16.4	246,000	40,267
Salt Lake City..	16.0	116,000	18,503
Denver	15.9	222,000	35,365
Seattle	15.7	285,000	44,810
Wichita	15.6	57,400	8,938
Houston	15.4	106,000	16,477
Oklahoma City ..	15.3	65,000	9,919
Portland, Ore. ..	15.3	255,000	39,101
St. Joseph, Mo...	15.2	79,800	12,094

The report then gives some world statistics of the telephone for 1911.

January 1, this year, the Interstate Commerce Commission promulgated its classification of telephone accounts and nearly all of the telephone companies, as well as the state commissions, are endeavoring to follow the system prescribed as nearly as possible. The system seems at this time to be complete and so arranged as to give any class of information desired.

There is little to say relative to telegraph rates and service. From investigation there is apparently less complaint against this utility than any other. With perhaps the exception of the American Telephone & Telegraph Company assuming control of the Western Union Telegraph Company there has been little change in this utility.

The Report on Rails and Equipment, presented by James E. Sague, contained some interesting information about the speed recorders, and their aid to safety of operation. Referring to the derailment of the Twentieth Century Limited near Hyde Park, N. Y., on March 13, 1912, he said there was reason to believe that the speed recorders in use at that time were not very accurate; there was also reason to believe that the clocks in the reporting towers were not as uniform as they should have been. There is an urgent need of a reliable speed indicator and recorder for use on fast passenger locomotives to show engineers the speed which they are making and to enable superintendents and train masters to check excessive speeds and secure the maintenance of a uniform average. Some effort has been made in this country to secure and use such an apparatus.

One of the most important features of safety that grows out of the use of electricity as a motive power is the use of the steel car, and its rapid adoption has been very largely due to the electric operation in the New York City terminals and to the necessities of subway service.

New Electrical and Mechanical Appliances

25,000-Kilowatt Unit for Commonwealth Edison Company.

There has been shipped to the Commonwealth Edison Company, Chicago, from the Heaton Works at Newcastle-on-Tyne of C. A. Parsons & Company, Limited, the largest turbogenerators yet completed. It is designed for a continuous load, at 750 revolutions, of 25,000 kilowatts, at a power-factor of 0.95, the periodicity of the three-phase current being 25 cycles per second. The steam consumption guaranteed is notable, as it marks an epoch. With steam at an initial pressure of 200 pounds per square inch, superheated to the extent of 200 degrees Fahrenheit, and an absolute pressure in the condenser equivalent to 1 inch, the steam consumption guaranteed at 20,000 kilowatts is 11.25 pounds per kilowatt output from the alternator; at 25 per cent over or under the normal load, 11.65 pounds per kilowatt output; and at half-load, 12.5 pounds per kilowatt output. The steam consumption guaranteed for this turbine set is equal to 8.1 pounds per shaft-horsepower-hour. The following description and illustrations of this unit are taken from *Engineering*.

The new Parsons set is to be installed in the Fisk Street Station; this was built in 1903, and is now being enlarged to a total capacity of 210,000 kilowatts; the Quarry Street Station, built five years later, has a capacity of 84,000 kilowatts; while the new Northwest Station is to have a total capacity of 160,000 kilowatts. With miscellaneous plants and storage batteries the collective capacity will become 480,000 kilowatts. The set includes a high-pressure and a low-pressure turbine arranged in tandem and coupled together through a rigid coupling, the flanges being forged solid with the shafts; an alternator connected to the low-pressure turbine rotor through a flexible coupling of the well known Parsons claw type; and at the extreme end an exciter. The condenser is suspended from the low-pressure turbine, its weight being also partly carried by springs. The low-pressure turbine is of the double-flow type, the steam entering at the center and passing, to right and left, through successive stages of expansion, exhausting at both ends, and flowing thence into the condenser through a rectangular orifice. At the high-pressure end there is mounted governing gear, designed to keep the variation in speed within very fine limits. The overall length is 76 feet 2 inches, the greatest width is 18 feet, and the height from the base of the condenser to the highest portion of the turbine is 30 feet. Of this, 20 feet is under the floor level.

The high-pressure turbine is of the single-flow parallel type, the end pressure being balanced by means of three dummy pistons of the Parsons standard design. This turbine, which has six stages of expansion, with sixty-four rows of blades, is designed for rather less than half the total load. The body of the rotor is of forged steel, the shaft at the steam inlet end being forged solid with the turbine drum, while at the exhaust end the drum is shrunk on, and securely bolted to, a separate forged-steel shaft, in order to prevent any possible relative movement due to changes of temperature. The blading in the high-pressure turbine ranges in length from 2.75 to 6.5 inches for the six stages, and each blade was caulked in separately, along with its distance-piece.

The casing is built up in four sections, two below and two above. The

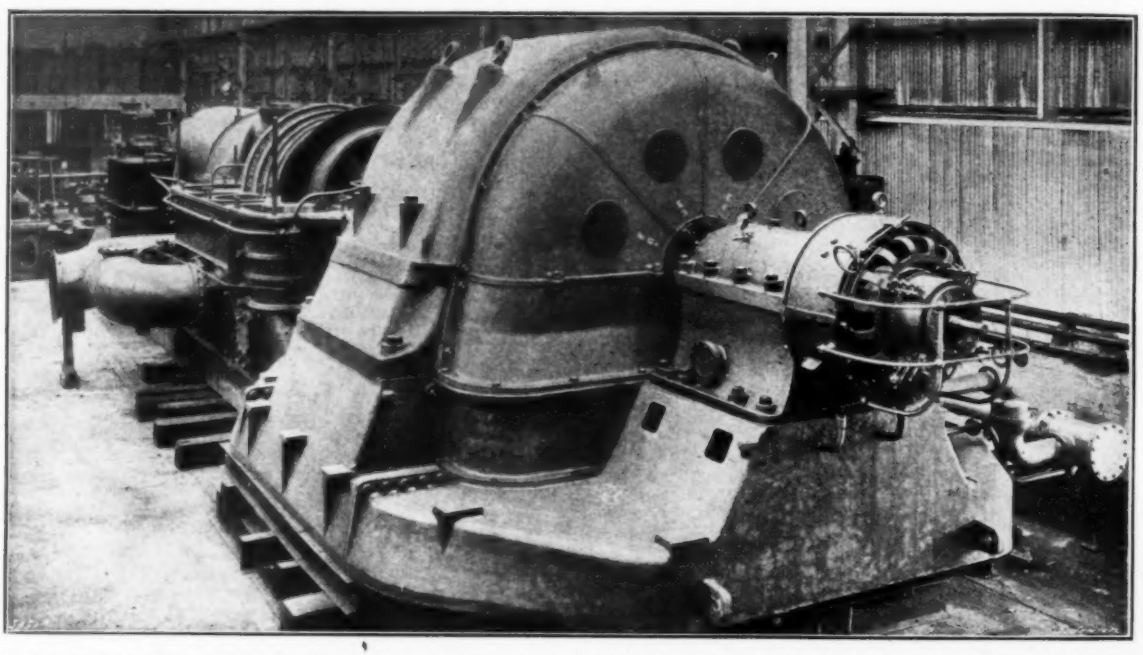


Fig. 1.—25,000-Kilowatt Parsons Generating Unit in Shops of Its British Manufacturer, Showing Alternator End with Exciter at Extreme Right.

material used for the high-pressure end is cast steel, and for the remainder cast iron. Cast steel has been used for that part subjected to the high temperature of the superheated steam, as experience has shown that with such high temperatures the growth of cast iron is invariably experienced.

The low-pressure turbine is of the original Parsons double-flow design. The steam from the high-pressure turbine passes through two 30-inch diameter pipes connected to a central chamber on the low-pressure turbine. The steam, entering the casing at a pressure of 25 pounds absolute, divides, part passing to the right through twenty-four rows of blades in six stages of expansion, and part to the left through a similar number of rows of blades. The steam finally reaches the condenser through a rectangular orifice 21 feet long by 12 feet wide.

The casing of the low-pressure turbine is of cast iron throughout, the total weight being about 150 tons. The bottom portion is built up in four sections, the top in two sections.

The blading in this, as in the high-pressure turbine, is of the separate reaction type, held in place by single or double caulking, according to the height of the blade and the depth of the groove. The blades in the low-pressure turbine are arranged in six stages, ranging in height from 2.75 to 19 inches. The blades subjected to superheated steam in the high-pressure turbine are of copper, and the remainder of brass. All blades are thinned at the tips, and are reinforced circumferentially by binding-strips, silver-soldered to them. Steam-packed glands of the Parsons standard type are fitted at each end of the low-pressure turbine, the steam for these glands being taken from the exhaust of the governor steam-relay, as will be explained later.

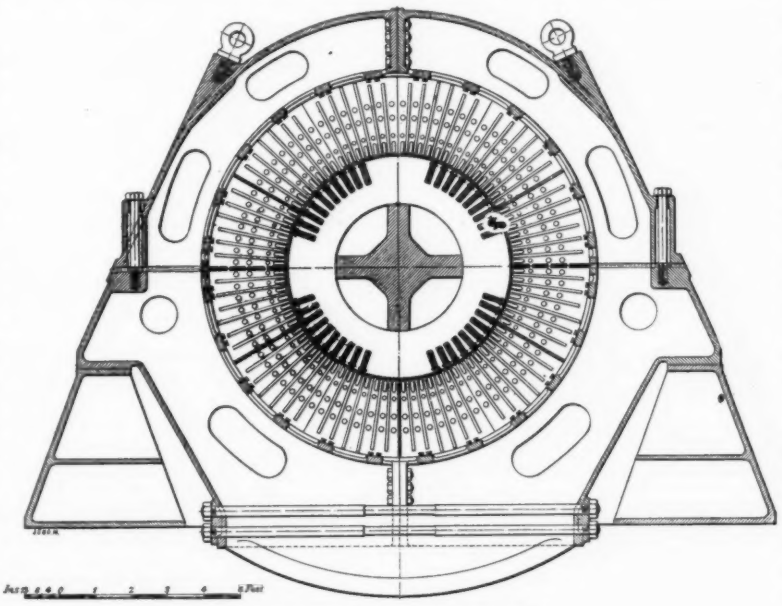


Fig. 2.—Section through Alternator of the Unit.

Between the high-pressure and low-pressure turbines there is fitted a rigid coupling, longitudinal expansion being provided for at the inlet end of the high-pressure turbine. This is effected by allowing the foot of the turbine to rest on the pedestal between slipper side guides.

The surface condenser has a cooling surface of 39,300 square feet. The sagging-plates and water-ends are of cast iron, and the tube-plates are brass. The tubes are one inch in external diameter, being rather larger than usual, to obviate deposits from the circulating water. They are arranged in two nests; the circulating water enters at the bottom through a rectangular orifice, 5 feet 9 inches by 2 feet 2 inches, and, after passing through the lower nest of tubes, flows to the upper nest, and out through a 48-inch diameter discharge branch. The condenser is suspended from the low-pressure turbine casing, but a large proportion of the weight of the condenser and circulating water contained therein is borne by eight spring supports under the condenser. In the hydraulic tests in the erecting shop about 38,000 gallons of water were required to fill the condenser and low-pressure turbine casing.

The alternator carries an ordinary three-phase star-connected winding, the end windings being arranged in two banks. Two of the phases are carried across the magnetic joint in the stator casing, and in the case of these phases each conductor is provided with a separate bolted joint to enable the top half of the stator to be lifted away. The rotor may be described as being of the cylindrical type with form-wound coils, the ends of the coils being carried by massive bronze end-bells.

The casing, which is of cast iron, is made in four sections, two sections bolted rigidly together forming the bottom half, and two forming the top half, the core being divided along the horizontal center line. The core is built of stampings of thin sheet-iron arranged in forty-four groups or sections, with a ventilating space adjacent to each. The total length of the core is 92

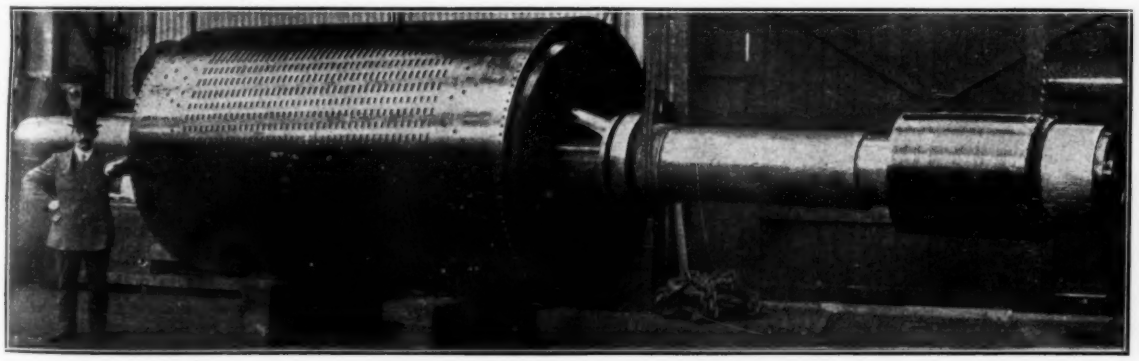


Fig. 3.—Rotor and Exciter Armature in Position on Shaft.

inches, and the diameter of the bore 75 inches. The weight of one-half of the stator, without windings, is 112,000 pounds. There are 84 stator bars. The bars are 10 feet long, and are drawn into completely closed slots, measuring 4.5 by 1.2 inches, there being one conductor per slot. The outside insulation of the bars is molded to gauge in order to ensure that they would be so wedged in the slots as to prevent movement. The end windings are of copper strip.

The rotor is of the slotted-core type, consisting of 32 forged-steel disks mounted on a forged-steel shaft. The over-all length of the shaft is about 30 feet, and the maximum diameter 3 feet 6 inches. Fig. 2 shows the disks with the coil-keys fitted, mounted on the shaft. The field windings are form-wound. The embedded portions of the coils are placed in troughs of leatheroid, and, after being pressed down by means of hydraulic jacks, are firmly secured against the action of centrifugal force by brass keys. The leading dimensions of the rotor are: length over end-plates, 10 feet 10.25 inches; pole-face, 7 feet 6.25 inches; diameter, 6 feet 2 inches. The rotor is carried in two bearings, each 18 inches in diameter by 48 inches long. The total weight of the complete rotor is 110,000 pounds. Fig. 3 shows the completed rotor of the alternator with the exciter armature mounted in position.

The alternator is completely inclosed, cast-iron shields being bolted to each end of the stator casing and jointed to the bedplates. These shields form the conduits for the cold air, which is supplied by a motor-driven fan and conveyed through ducts formed in the foundations. The air after passing through the stator and rotor is discharged through an orifice formed in the bottom of the stator casing. Provision is made for the passage of 80,000 cubic feet of air per minute to ensure that, after continuous running at 25,000 kilowatts and 4,500 volts, no part of the alternator shall have a temperature rise exceeding 70 degrees Fahrenheit. The fan is capable of supplying the above quantity of air at a pressure of 3.5 inches of water.

The exciter is of the overhung type mounted direct on the alternator shaft (Fig. 3). The magnets are carried on a flanged extension cast on the alternator end-bearing pedestal. The exciter is arranged as an ordinary shunt-wound four-pole 250-volt self-excited generator.

Electric Cooking at New York Show.

That the electric range meets the requirements of restaurant and hotel service perfectly was demonstrated at the New York Electrical Show. An electric grill and tea room was run in connection with the exhibit of the New York Edison Company, and the food served was cooked wholly with electrical devices, the latter comprising a hotel-type range, a grill of the same type, and two ovens.

To serve the large number of people who patronized the grill room, it was necessary that the range be operated at its full capacity from 9 o'clock in the morning until 10 o'clock at night, and it proved to be indispensable.

The range is provided with two roasting ovens and a top cooking surface comprising eight rectangular hot plates.

The ovens are of liberal size, being 18 inches wide, 16 inches high and 28 inches deep, have double walls and are insulated with Navy Firefelt, placed between the walls to prevent the escape of heat. They are ventilated by means of flues which communicate with an opening in the top of the range.

Each oven is provided with two Calorite heating units of the two-heat type, one being located at the top and the other at the bottom, thus giving a range of four heats for each oven, the power consumption being respectively 1,600, 2,400, 3,200 and 4,800 watts.

The eight rectangular hot plates are all of the same size, being 9.25 inches wide by 12 inches deep, and the heating unit of each is designed for but one heat. The power consumption of each of the four front ones is 1,600 watts, as they are designed to have a high temperature for

New Electric Range, Showing Switch Compartment Open.

Same Range with Switch Compartment Closed and Ovens Open.

rapid work, while that of the back four is 800 watts, so as to render them suitable for slow boiling.

The hot plates are 33 inches above the floor, just the right height for convenience in handling the receptacles on them.

The main circuit is closed through a double-pole circuit-breaker and in addition the circuits to the individual heating units are protected by fuses and controlled by knife switches. The switches, fuses and circuit-breaker are mounted on a slate panel located at the top of the range and inclosed in a sheet-metal compartment provided with a roll-top door.

The heating unit that each switch controls is indicated by a name placed directly above the switch, so that, to ascertain what heating units are in operation, one has only to roll up the door and glance at the switches. An aperture at the bottom of the back of the compartment ensures a circulation of air over the devices mounted on the panel.

Conductors are brazed to the Calorite heating units, so that there are no connections that are likely to work loose from alternate heating and cooking. These conductors are carried through conduit to connection blocks and there connected to the terminals of the respective power circuits.

The framework of the range is substantial, being constructed of angle-iron firmly bolted together. The range front and the door frames are of heavy steel plate, while the hot plates and end frames of the panel box are iron castings. The walls of the oven are of sheet metal.

All sheet-metal parts are of blued steel, while the other parts are finished in "marine" or dull black.

All heating units are replaceable and the design is such that the hot plates can be raised up to permit cleaning the catch pan located underneath.

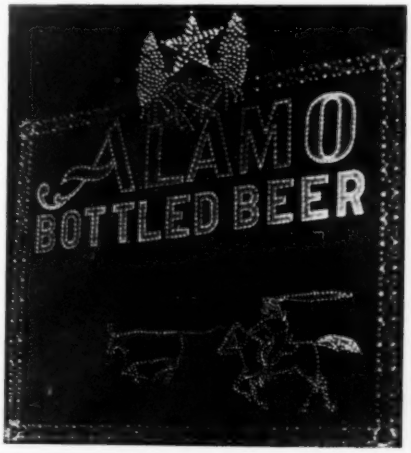
The overall dimensions of the range are: width 44 inches, depth 38 inches, height 68 inches.

This is a new range and in addition to the one used at the New York Electrical Show, two have been sold to the St. George's Hospital, Montreal, and two to the Bethlehem Steel Works.

The range is manufactured by the General Electric Company, Schenectady, N. Y.

Unique Flashing Sign for a Texas Brewery.

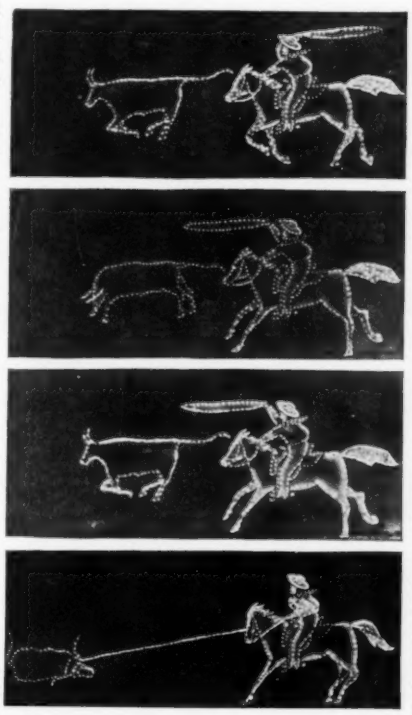
The flashing sign recently installed by A. H. Cadwallader, sign specialist, for the Lone Star Brewing Company, of San Antonio, Texas, is 50 feet high by 50 feet wide, and has the true Texan flavor throughout. An eight-foot star at the top of the sign is the emblem of Texas, and it is surrounded by a cluster of "blue bonnet," the state flower, colored by blue and green color caps. The border consists of wheels which rotate in cog fashion, one turning to the left, the next to the right, and so on, resulting in the unique whirling effect of a series of whirligigs going in different directions and flashing different colors. When the



Unique Sign of Lone Star Brewery.

sign is flashed on, the words "Alamo Bottled Beer" appear, followed by a roping contest.

A cowboy mounted on a Texas pony, is seen chasing a steer at full speed. He swings his lasso several times



Some of the Changes in the Sign.

about his head, then throws it over the horns of the steer. The horse stops, rears on his haunches, and the steer turns a somersault, landing on the ground in the most realistic manner. This "roping" scene is remarkable for its fidelity to actual practice. Since it was realized that the sign would constantly be seen by men who had spent the greater part of their lives on a ranch, and would quickly detect anything wrong in the reproduction, a moving-picture concern was called in, which together with a real "cow puncher," made it possible to reproduce in the most natural manner all the movements of man, steer, and horse.

In all other respects also the utmost pains were taken to make this sign installation a success. Mr. Cadwallader was sent to visit all the principal eastern cities, particularly New York, and to confer with the leading sign makers. The sign contains 4,000 2.5-watt, 12-volt Buckeye Mazda sign lamps furnished by Martin Wright, the Buckeye agent at San Antonio, at a total cost of $7,500. All the working drawings for the sign and the entire wiring diagram were made by W. S. Ryan, engineer for Betts & Betts, of New York, who visited San Antonio in person.

Six More Powerful Electric Locomotives for the New York Central Terminal.

The New York Central & Hudson River Railroad Company has recently ordered six additional powerful passenger electric locomotives from the General Electric Company for terminal service at New York City. Early in the year ten electric locomotives of the most powerful type ever built were ordered from this company for the same service. These engines weigh 100 tons each and were described in our issue of April 26, 1913. While the new machines are of the same type and construction, they are somewhat heavier, weighing 110 tons, and due to recent advancement in locomotive design, have materially increased capacity for continuous service.

The growth in traffic and the corresponding increase in the demand for larger and heavier train units since the introduction of electric locomotives in the New York Central terminal has been indeed notable. In 1906, 35 600-volt, direct current, passenger locomotives were built by the General Electric Company and introduced in the terminal. These machines are of the 115-ton type and are each equipped with four GE-84 bipolar, gearless motors. Twelve more engines of the same type were placed in service in 1908. All these locomotives were designed with sufficient tractive effort to operate trains of 535-ton gross weight at 60 miles per hour in the regular terminal service.

The ten 100-ton electric locomotives ordered early this year are each equipped

with eight GE-89 bipolar, gearless motors, all the weight of the machine being carried on motor-driven axles. These engines are designed for pulling the heavy limited trains and will exert sufficient tractive effort to operate 800-ton trains in continual service between the New York Central terminal station and Harmon. They are capable of operating a 1,000-ton train in emergency service or a train of the same gross weight on level tangent track continuously, at 60 miles per hour, or an 800-ton train at 65 miles per hour.

But the weight of trains which are being hauled out of the terminal is increasing steadily, and some of the more important passenger trains now weigh over 1,000 tons. It has therefore been deemed desirable to have engines for the maximum service with very great continuous capacity, ample overload capacity and high momentary rating. The new locomotives are able to exert practically the same tractive effort continuously that the previous ten locomotives can for one hour.

The increase in weight of 10 tons in these machines is accounted for mainly by the greater amount of material in the motors, which are of larger capacity. The speed and torque characteristics of the locomotive have been kept practically the same as those of the former ten machines, but the new locomotives are capable of hauling approximately 40 per cent greater tonnage in continuous service.

The previous ten 100-ton locomotives have a capacity for developing 1,460 horsepower continuously, 2,000 horsepower for one hour and can develop as high as 5,000 horsepower for short periods. This corresponds to a tractive effort of 9,000 pounds at 60 miles per hour continuously, or 13,500 pounds at 54 miles per hour at the one-hour rating. The six new electric engines will develop 2,000 horsepower continuously, or 2,600 horsepower for one hour. The equivalent tractive effort is 14,000 pounds at 54 miles per hour continuously, or 20,000 pounds at 49 miles per hour at the one-hour rating. They are able to haul 1,100-ton trains in continual service between the terminal and Harmon, are capable of operating 1,200-ton trains in emergency service, and 1,200-ton trains on level tangent track continuously at 60 miles per hour.

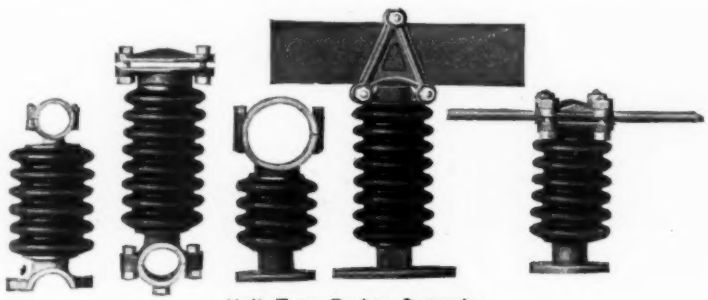
In point of design and construction the new machines will be of identically the same type as the former ten engines, having an articulated frame with bogie guiding trucks at each end. The cab containing the engineer's compartment and that for the operating mechanism is swung between the two parts of the frame on center pins. Each section is equipped with two-axle trucks having a driving motor mounted on each axle. All the axles are, therefore, driving axles. The eight motors, of the bipolar gearless type, are of the same general design as the motors on all the previous 37 locomotives, and are provided with ample forced-air ventilation.

The motors are electrically connected permanently in parallel in pairs, and the pairs can be connected in three combinations, viz., series, series-parallel and parallel. They are insulated for 1,200 volts, so that if at any future time it should be desired to operate the locomotive on this voltage, the pairs of motors could be changed from parallel to series connections and the same speeds and control combinations obtained as on 600 volts.

The new locomotives are now under construction in the works of the General Electric Company at Schenectady, N. Y., and will be placed in operation as soon as completed. Compared with existing types of electric engines, these machines have greater capacity and higher efficiency than any other high-speed electric locomotive ever constructed, and yet their total weight, weight per driving axle and dead weight is less than that of any other locomotive approaching their capacity.

Unit Type High-Tension Busbar Supports.

A new type of high-tension support for interior station wiring, busbar work, compartment service, etc., is illustrated herewith, and has many novel features. The fundamental unit is made up of wet-process brown-glazed porcelain in each of which is a recess into which is "key cemented" a threaded malleable-iron thimble. With such a design it will be readily seen that any desired fitting can be secured to the insulator unit, a few for the various commercial forms being shown. With the standard fittings commercially available over 7,000 combinations can be made up and the many different problems heretofore encountered in laying out busbar compartments, etc., can easily be solved with this new unit.



Unit Type Busbar Supports.

A distinct advantage of this new type is the decided gain in space possible when building compartments; owing to the fact that there are no overhanging projections cutting down the creepage distance, the compartments can be made smaller than necessary with the older forms and this in turn effects a large saving as compartment work is relatively expensive. The characteristics of the "unit type" support are well illustrated by the following tabulation showing the high factor of safety secured.

Normal Rated Voltage	Flashover Test Voltage
6,600	30,000
13,200	54,000
22,000	75,000

The possibility of carrying units in stock readily adapted for assembling in any desired form will be appreciated by every constructing engineer heretofore hampered by the limitations of the older form busbar support. This new form of "unit type" busbar insulator is manufactured by the Delta-Star Electric Company, Chicago, Ill.

Electrically Operated Auto Signal.

An electrically operated automobile signal that is proving popular among autoists and pedestrians alike has been invented by Edward E. Peck, of Los Angeles, Cal., and is now being manufactured by the inventor in that city. This device consists of four small signs or signals, one of which is placed on each of the four fenders of the machine, two facing to the front and two to the rear. Each of these signs forms a half-circle, the two on the front containing arrows indicating the direction in which the driver intends turning his car, while those in the rear read "right" and "left." When the driver intends going straight ahead each of the signs is left blank. The intention is to permit the driver to warn all pedestrians and auto drivers, when the corner is reached, of the exact desire of the operator of the machine. The little signs that are placed on the rear fenders give warning of the intention of the driver of the machine to the driver of the car that is approaching the same corner just behind him.

Although the intention is to secure power from the storage battery of the car to run the signal, it has been found that the system is so light of operation

that two small dry cells will operate it. This signal system is manipulated by the driver by means of a small lever placed conveniently on the steering wheel of the car. When it is desired to turn to the left the lever is thrown to the left; when to the right the lever is thrown to the right. This operation, after a little practice, becomes as easy and natural as blowing the horn or applying the brakes.

The signal is so made that it is entirely weatherproof and may, with safety, be used during rainy or snowy weather of the worse kinds. When "normal" the arrows and names are covered by a dark-red silk curtain. At the switching of the lever this curtain quickly disappears through a slot at the under side of the side. When the corner is passed and the lever thrown back to "normal" the curtain returns instantly. These signals are finished in any color to match the fenders of any machine. They work noiselessly.

The arrows and words each measure about two by six inches in size. At night the sign is made visible by a tiny electric lamp placed behind the arrows and names. The firm manufacturing this device is known as the Quartette Auto Signal Company of Los Angeles.

Electric Signal for Automobiles.

Pneumatic Conduit Fisher.

One of the most annoying and time-consuming features of interior conduit wiring is the fishing of the circuit wire into difficult stretches of finished conduit runs. When there are many elbows, offsets or other obstructions the use of an ordinary fish tape is not productive of economy in either labor or time. Frequently plaster, chips of wood and other foreign substances are lodged in the conduit with resultant sweating and "cussing" on the part of the wireman in his efforts to remove or get by the impediments.

To overcome these difficulties there has been developed and placed on the market a pneumatic conduit fisher. Its operation is readily understood from the accompanying illustrations. A powerful foot pump is connected with a storage tank. On top of this is a valve coupling for a flexible air hose. A light traveler, consisting of a spindle with three thin but strong disks and a hook for the attachment of a string, is inserted into the end of the conduit and the hose applied thereto. By turning on the air the traveler is driven through the conduit with great force and speed, dragging along the string and incidentally removing obstructions. Instances are recorded where the device was used with complete success on runs of 150 feet containing as high as seven elbows; not only was the string drawn in within a few seconds, but the conduit cleaned of all plaster and dirt. Even water has been removed in this manner.

Traveler Pulling String.

Pneumatic Conduit Fisher.

A thin but exceptionally strong string is used, something like fish cord. This suffices for drawing ordinary wires through without any special fish tape. Where very heavy wires or cables are to be drawn in, a light wire is first pulled in by the string and the cable drawn in by this wire. The entire weight of the machine is about 40 pounds. Handles on the tank permit its ready removal from place to place.

String Pulling Wire.

The device is manufactured and sold by the Pneumatic Conduit Threader Company, 12 North Eighth Street, Richmond, Va. It has been highly recommended by wiring contractors that have used it.

New Porcelain Pull Socket.

A new porcelain pull socket has been placed on the market by the Arrow Electric Company, of Hartford, Conn. As illustrated below, instead of being equipped with the ordinary ball chain the socket is operated by a short piece of strong weatherproof cord to which is fastened the insulated chain. The cord slides easily through the opening in the porcelain shell, making an easy-acting socket, and the cord has been proven by tests to be even more durable than the ball chain on this type of socket.

A New Wood Preservative.

A new preservative for preventing and removing dry-rot and other fungi destructive to wood is being introduced under the name of "Mykantin," by Lucius and Brüning, Limited, 3 Jewry Street, London, Eng. Apart from the fact that "Mykantin" possesses a highly destructive power on wood parasites, it is claimed to have a number of advantages, all of which cannot be ascribed to the majority of the preservatives in use. The material does not volatilize like corrosive sublimate, and does not increase the combustibility of wood which is treated with it. Further, it keeps indefinitely, and does not affect the mechanical strength of wood, or attack fabrics, iron, zinc, etc. It carries no strong odor, and is readily soluble in water, so that a solution applied to wood easily penetrates some distance below the surface. In this latter quality it compares favorably with tar products, which demand high pressure if they are to be forced into the material.

Arrow Porcelain Pull Socket.

Wagner Single-Phase Synchronous Converters.

There are many places where direct current is necessary but where the supply is from an alternating-current circuit of the single-phase type. For the rectification of this current have been developed many devices which are more or less suitable for particular installations. The most efficient is the synchronous or rotary converter. However, it has formerly been considered impracticable to use synchronous converters of small sizes, particularly when these must change a 60-cycle single-phase current.

To meet the evident need for a machine of this character the Wagner Electric Manufacturing Company, St. Louis, Mo., has developed a single-phase converter embodying many unique features and designed in such a manner as to require relatively little attention. Thus the machine is well adapted for service where an expert electrician is usually not available.

Fig. 1 shows a machine of this type. The field part of the machine, instead of being made up with ordinary projecting poles, is wound in a distributed manner similar to the stator of a single-phase motor. In addition thereto there is a compensating winding to produce sparkless commutation. The rotor winding is of standard synchronous converter type. It is practically like that of a direct-current motor with the exception of having two taps taken from points diametrically opposite on the winding and connected to the collector rings at one end of the machine. The commutator is connected substantially as a direct-current motor or generator. Since in any converter there is a definite ratio between the alternating-current supply and the direct current obtained from the machine, variation of the direct-current voltage is obtained by a series of adjustable taps on the transformer supplying the alternating-current side of the converter.

Fig. 1.—Single-Phase Synchronous Converter.

The machines are started in a very simple manner. The main four-pole starting switch is thrown to the starting position; in this case part of the compensating winding is connected in series with the armature and the machine starts as a series single-phase motor, attaining full speed in about five seconds. At this point the four-pole switch is reversed to the running position in which the leads from the collector rings are connected to the alternating-current mains, the compensating winding being at the same time interconnected and the shunt field connected to the direct-current terminals. Since with this simple method of starting the polarity of the direct-current side may be wrong, a double-pole double-throw switch is provided on machines where a definite polarity must be given. Thus, if the polarity is wrong, the switch is reversed.

These converters have been found serviceable for a variety of purposes, including the operation of projecting lamps in moving-picture theaters, for charging electric-vehicle batteries and other storage batteries, for supplying X-ray outfits, as well as for any other purposes requiring direct current. Where desired a pulley can be supplied on the armature shaft so that it can also operate as a motor. Fig. 2 shows such a use. In this case the converter, operated as a motor, drives the short shaft operating a variety of tools; at the same time, operating as a converter, it is used for charging automobile storage batteries for ignition and lighting purposes. Fig. 3 shows an installation of two Wagner converters in the Fleishman garage at Washington, D. C. These machines operate on 220-volt single-phase circuits and supply direct current up to 70 amperes with a voltage range from 65 to 150 volts, this voltage adjustment being obtained by means of transformer taps.

As an evidence of the progress of the Philippine Islands it may be stated that pay-as-you-enter street cars of the center-entrance type are to be placed on the Manila electric lines.

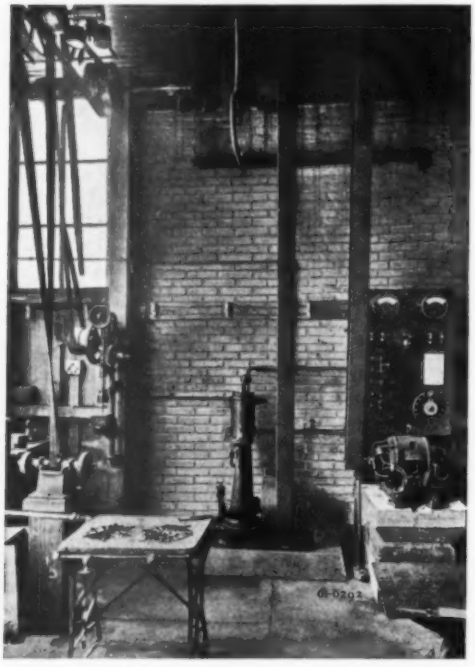


Fig. 2.—Machine Used as Converter and Motor.

Fig. 3.—Battery-Charging Converter Sets.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

TUCKERTON, N. J.—Tuckerton is planning an electric light plant.

HARLEM, MONT.—The Council is considering building a municipal electric plant. C.

THORNTON, IOWA.—An agitation has been started for an electric-light system here. C.

ELGIN, ILL.—Elgin has authorized a bond issue of $162,000 to build an electric light plant.

HAMBURG, IOWA.—Electroliers will be installed on Main Street. Address J. F. Baldwin for information.

LEITCHFIELD, KY.—The Leitchfield power and electric light plant was damaged by fire, the loss being $5,000.

MORRISTOWN, PA.—The Schwenksville Electric Light Company has been organized, and will apply for a charter.

SIDNEY, MONT.—W. L. Bell, E. S. Adams and others are interested in the establishment of an electric light plant here.

WHITE, S. D.—A franchise has been granted to George Blaisdel for the operation of an electric-light and power system. C.

LORAINE, O.—The Wood Lumber Company will substitute electricity for steam power; 21 individual motors will be installed.

HARDIN, MONT.—The Council is planning ways and means to install electric lighting. Address the city clerk for particulars.

SAN DIEGO, TEX.—The electric light plant which was recently destroyed by fire, will be rebuilt. S. G. Smith is interested.

LA HARPE, ILL.—The merchants of La Harpe contemplate installing 16 ornamental lights on three blocks in the business section. Z.

LENNOX, S. D.—The Lennox Electric Company will build a plant here and furnish light and power to Chancellor and Worthing. C.

BELLINGHAM, WASH.—The Sumas Electric Company has been granted a franchise for a transmission line from Sumas to Everson.

BRIGEPORT, ALA.—J. W. Adams, of Chattanooga, Tenn., and associates, are considering the establishment of an electric light plant here.

PHOENIX, ARIZ.—The Council plans to expend $25,000 for electric-light improvements. Address the mayor in regard to this project.

FLORENCE, WIS.—A transmission line will be built to Commonwealth and the local company will furnish light and power for street lighting. C.

PENSACOLA, FLA.—J. Harvey has asked permission of the Board of Commissioners of Escambia County to establish a power plant on Perdido River.

MENOMONIE, WIS.—The Chippewa Valley Railway & Lighting Company has been awarded a four-year contract to light the city streets.

MARSHALLVILLE, GA.—$5,000 will be expended establishing an electric light plant here. Address J. O. Booton, mayor, in regard to the matter.

MT. VERNON, O.—The Council is planning ways and means to establish a municipal lighting plant. Address City Clerk Wotten for information.

PATERSON, N. J.—The Public Service Corporation will remove its overhead lines and install an underground conduit system in the central part of the city. A.

DUNCOMBE, IOWA.—The Duncombe Light & Power Company has been incorporated with a capital stock of $10,000. W. J. Wagner, of Duncombe, is president.

BALTIMORE, MD.—The Electric Toy Manufacturing Company has acquired property in Newark, N. J., and will establish a plant for the manufacture of electrical toys.

OWENSBORO, KY.—Second Street merchants have arranged for the extension of the "White Way," recently established in that city, to their section of the business district. G.

LOUISVILLE, KY.—The city of Louisville is arranging for the installation of an electric light plant at the city workhouse. The Board of Public Safety may be addressed. G.

PETALUMA, CAL.—An ordinance is before the Council ordering all electric light and telephones wires to be placed underground. Address the city clerk for desired information.

SUPPLY, OKLA.—$19,000 in bonds has been voted for the installation of an electric light and water works plant here. Address C. Devoe, Chairman of the Board, for information.

MILWAUKEE, WIS.—F. G. Simmons, Commissioner of Public Works, will soon advertise for bids for electric lights for the city streets on contracts extending from three to five years. C.

ASHLAND, ORE.—H. G. Butterfield recently submitted a petition to the city asking for a $25,000 bond issue to be used in constructing an auxiliary electric light plant, same to cost about $16,000. O.

SPRINGFIELD, ILL.—A committee of business men has asked the City Council to have the wires of electric light, telephone and telegraph companies in the downtown district placed underground. Z.

NAUVOO, ILL.—The City Council has awarded a contract to Joseph Nelson to light the city streets. The contract calls for 30 350-watt tungstens, lighted from dusk to 2 a. m., at $5 per lamp per month. Z.

AMARILLO, TEX.—The City Light & Water Company, which was recently purchased by the Doherty interests of New York, is reconstructing its power plant and will make improvements amounting to over $100,000. D.

LA CROSSE, WIS.—Manager R. M. Howard of the Wisconsin Railway, Light & Power Company, will make improvements here, build a transmission line to Hatfield and operate street cars by power from there. C.

WAVERLY, IOWA.—The City Council of Waverly has decided on the purchase of a new dynamo or generator for the light and power plant to cost over $7,000. Address the city clerk for particulars.

WARSAW, ILL.—The City Council is considering the installation of an ornamental lighting system along the levee from Ninth Street to Main Street, using six steel posts to a block and three lamps to a post. Z.

DUNKERTON, IOWA.—At a special election it was decided to grant J. A. Renz a franchise for the installation of an electric light plant that will supply both the city proper, private homes and business establishments with electric lights.

SAYREVILLE, N. J.—The Township Committee is planning for the installation of additional street lights in connection with the renewal of its contract for service, soon to be made, with the Sayreville Electric Light & Power Company. A.

SEATTLE, WASH.—The Puget Sound Traction, Light and Power Company proposes stringing light and power transmission lines from The Meadows near Georgetown to Black River Junction, in order to serve the farmers in that vicinity. O.

FITHIAN, ILL.—At a special election a proposition was carried whereby the village will purhase the electric distributing system, contracts and franchises of O. B. Wysong. A bond issue of $4,000 for the purchase also was ratified. Z.

CUERO, TEX.—The Cuero Light & Power Company has been granted a 50-year franchise by the City Council and is planning to build a new dam and power house several miles below the present dam to afford more power.

SIOUX CITY, IOWA.—Charles Schenk, general manager of the Peerless Shocker Manufacturing Company, has stated that it is the intention of his company to erect a plant in this city for the manufacture of its products next summer.

SULLIVAN, ILL.—The City Coun-

cil has inspected the municipal electric light plant of Shelbybille, Ill., and it is proposed that new equipment be added to the municipal plant here and that the city will go into the commercial lighting business. Z.

PERTH AMBOY, N. J.—In connection with its new commercial fertilizer plant to be erected at Roosevelt, near Perth Amboy, The Consumers' Fertilizer Company will build a power plant for factory operation. The entire manufacturing plant is estimated to cost $200,000. A.

CAMERON, WIS.—Red Cedar Valley Electric Company will build a transmission line from here to Beckwith's Corners, within two miles of Barron, then north to the Robert Henderson farm, to furnish farmers with light and power. A line to Canton is projected. C.

PEORIA, ILL.—The Association of Commerce contemplates the purchase of either a gigantic electric searchlight or a sign "Welcome to Peoria" with letters 20 feet high. Secretary Spalding Slevin of the Publicity Committee has been instructed to secure estimates. Z.

WATSEKA, ILL.—Julian Shapiro, and Harry Fritch, manager the electric light company, have been canvassing business men of the city with a view of installing an ornamental lighting system. The plan is to use five-lamp clusters and iron standards. Z.

FINDLAY, O.—Pittsburgh and Cleveland capitalists are said to be backing a movement to erect a building here that will house a central heating plant, ice manufacturing apparatus, electric laundries and a combination of other interests. It will be run on the co-operative plan. H.

DAYTON, O.—The United Brethren Publishing concern of this city is installing its own steam heating and electrical plant. Two new high-speed elevators will be installed in the 14-story office building. Lights for the building and for the mechanical departments will be furnished by this plant. H.

SPRINGFIELD, ILL.—A committee of business men has asked the City Council to consider the installation of the ornamental lighting system in connection with the advent of the municipal electric light plant into the commercial lighting field. W. J. Spaulding, city commissioner, is interested. Z.

ZILLAH, WASH.—Manager George Sawyer, of the Pacific Power & Light Company, North Yakima, recently petitioned the County Commissioners for right of way over county roads in this district, on which to construct and maintain poles and wires for a three-mile power line for irrigation and power purposes. O.

FAIRBANKS, ALASKA.—The Canadian-Klondike Mining Company plans extending its light and power lines from Dawson through the 40-mile district, the Eagle District, the Circle District, to Fairbanks, furnishing power to everybody along the route. Definite plans will be formulated within the next month. O.

MORRIS, ILL.—The installation of a new street lighting system is contemplated. The Northern Illinois Public Service Company wishes to install ornamental clusters on iron poles of the interurban company if erected, and on its own poles if the traction company does not build its proposed lines. Z.

NORRIDGEWOCK, ME.—Bombazee Power Company has been organized here for the purpose of purchasing land and water power along the Kennebec River, and acquiring rights under the mill acts, with $50,000 capital stock, of which $17,000 is paid in. Charles H. Hussey, of Norridgewock, is president.

SANTA ROSA, N. M.—An electric light and power plant for this place is to be erected by J. O. Janes and C. E. McGinnis in connection with the irrigation project of the Santa Rosa Townsite Company, which they have just purchased from H. B. Jones of Tacumcari, N. M. An irrigation pumping system is also to be installed.

JUNEAU, ALASKA.—W. L. Lass and E. P. Kennedy, of Treadwell, contemplate the formation of a power Company for the purpose of developing and utilizing 100,000 horsepower, which can be developed in the Long Lake, Crater Lake and Speel River districts, a few miles south of Juneau. Mr. Lass is superintendent of the Treadwell mines. O.

MOSCOW, IDAHO.—The Washington Water Power Company, operators of light and power plants in Washington and Idaho, is making preliminary surveys previous to the extension of its power lines from Palouse, to this city. From this point distributing lines are to be run to Troy, Kendrick, Juliaetta, etc. The Company maintains headquarters in Spokane. O.

MARSHALL, TEX.—The Marshall Electric Company will install machinery in its electric power and ice plant here to greatly enlarge their capacity. A new 500-kilowatt steam turbogenerator; a 200-kilowatt railway rotary generator, and two boilers of 400 horsepower each will be installed in the power plant. E. L. Wells, Jr., is general manager of the company. D.

EDMONDS, WASH.—W. R. Ammon and A. A. Cobb, representing the Edmonds Electric Light & Power Company, have been granted a franchise to erect poles and string wires along the public highways into the town of Richmond Beach. Manager Ammon states his concern will spend several thousand dollars on the new line. Work will be started immediately.

BRATTLEBORO, VT.—The Central New Hampshire Power Company, which has its main offices in Brattleboro, has bought the plans of the Newport (N. H.) Electric Light Company and Sunapee Electric Company. It is understood that additional power will be developed and the power lines will be extended to Claremont. Plans are also under way for building a large storage reservoir in Croydon.

SACRAMENTO, CAL.—Sacramento and Alemeda parties have filed on water rights of Indiana Indian, Red Clover and Last Chance creeks in Plumas County, for hydroelectric developments. The estimated cost of the developments, which are to generate about 35,000 horsepower, is about $2,000,000. Plans provide for three storage reservoirs and the construction of a generating station at a central location to utilize the water from all three streams.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BLAIRSBURG, IOWA.—A 20-year franchise has been granted to the Doolittle & Brinton Telephone Company to operate here. C.

JACKSONVILLE, FLA. — The Home Telephone Company will erect a $30,000 building. More equipment will be purchased.

FORT VALLEY, GA.—The Fruit Belt Telephone Company is being organized here by R. E. Brown, Max L. James and others.

OXNARD, CAL.—A contract has been granted the Limoneira Company for the installation of 16 miles of private telephone line on ranch property.

NEW CANTON, ILL.—The Village Board has granted a 25-year franchise to G. L. White to construct and operate a telephone system in the village.

AMORET, MO.—The Amoret Farmers' Mutual Telephone Company will be incorporated to succeed the present company. A telephone exchange will be erected.

FORTVILLE, IND.—Alfont Telephone Company has been incorporated with a capital of $330. The directors are Charles Ifert, J. K. Rash and Noah Elisberry.

EDMONTON, ALTA.—About $2,000,000 will be spent by the Government in telephone extensions and improvements next year. New exchanges will be built here and at Medicine Hat.

MAPLETON, MINN.—At a recent telephone meeting held at the home of George Farnsworth in Grapeland, it was decided to make plans for rebuilding the Grapeland farmers line. C.

DILLON, MONT.—The Centennial Valley Telephone Company has decided to extend its lines in this section of the country at once. The Company owns and operates 150 miles of lines. O

ST. LIBORY, ILL.—The New Southwestern St. Libory Mutual Telephone Company has been incorporated with a capital stock of $500. The incorporators are John Mense, John Mueller and Henry Jaske. Z.

OKLAHOMA CITY, OKLA.—The Pioneer Telephone Company is planning to extend its line through Osage County, some 15 miles in length. The greatest difficulty experienced at this time is in securing laborers for proposed extensions. P.

ARBON, IDAHO.—The Falls Bannock Telephone Company has filed articles of incorporation. The company is capitalized for $4,000. The incorporators are T. B. Evans, D. J. Bowen, H. Bailey, John C. Cairns, J. E. Keeler, William Allard, David B. Ripley.

ALEX, OKLA.—A deal has been consummated by which Henry Graham, of Purdy, will take charge of the Alex telephone exchange and Manager Graham, of the local company, will take over the business which Mr. Graham is now conducting at Purdy. The plant here will be remodeled and a new switchboard installed. P.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted authority to the Pacific Telephone & Telegraph Company to issue $3,000,000 in bonds, the proceeds to be used to retire underlying bonds of the Sunset Telephone & Telegraph Company and for improvements in the company's system in various portions of the state.

ELECTRIC RAILWAYS.

(Special Correspondence.)

TIPTON, IND.—Eugene Burtelle has filed with the County Clerk blueprints for a proposed traction line from Tipton to Marion, by way of Windfall.

ARCADIA, FLA. — A company capitalized at $1,000,000 has been organized here for the purpose of building electric lines in this State.

JACKSON, TENN.—The Council has extended the franchise of the Jackson Railway & Light Company. The West Jackson car line will be built in the near future.

CHICAGO, ILL.—The Chicago & West Town Railway Company will issue $750,000 in bonds, part of which it is stated, is for the purpose of extension of its lines.

YOUNGSTOWN, OHIO. — The Ruhlman Railroad Company has been chartered with a capital stock of $10,000, to build an electric line from Liberty Township, to Steubenville Township. The incorporators are John H. Ruhlman, G. W. Caldwell, and others.

WINNIPEG, MAN.—Winnipeg Electric Railway Company has bought the franchises and charters of the Manitoba Power Company, Rural Railways and the Winnipeg River Railway Company. These include power sites on the Winnipeg River capable of development to 150,000 horsepower.

CHARLES CITY, IOWA.— At a combined meeting of the Charles City Business Men's Association and the Commercial Club, it was decided to electrify the Charles City Western Railway which now has a gasoline passenger and a steam freight service, and to extend the line so as to meet the Chicago Great Western line at some point.

MINNEAPOLIS, MINN.—The Minnesota Union Electric Railroad Company, in which Minneapolis men are interested, has filed articles of incorporation at Pierre, S. D., the incorporation plan being somewhat changed since the announcement about a month ago of the formation of the company. The capital stock is $2,000,000. E. C. Garwood of Minneapolis, one of the incorporators, said the company purposes constructing a line of electric road from Minneapolis into the country and eventually into South Dakota. Construction details, he said, are not yet worked out, but it is probable the road will build to St. Cloud. Associated with Mr. Garwood in the company are T. A. Chadwick and Achile Pouliot, Minneapolis, and G. M. Lawrence, Huron, S. D.

DENVER, COLO.—E. W. Merritt, a real estate dealer, is trying to interest a party of capitalists in the construction of an interurban electric railroad line which will connect Denver and its chain of mountain parks, and has asked the Park Board to vote an appropriation of $5,000 to make the necessary surveys and an estimate of the cost so that facts and figures may be presented the capitalists with whom he is in communication, who, it is claimed, will have several million dollars available for investment after the first of the year. There are four routes between Denver and the Bergen Mountain Park, by way of the Gennesee Park, which might be utilized for an electric line. The Park Board is considering the proposition.

NEW PUBLICATIONS.

FIRST-AID INSTRUCTIONS.—The Bureau of Mines, Washington, D. C., has issued Miners' Circular No. 8, entitled "First-Aid Instructions for Miners." This is a pamphlet of 66 pages which describes the anatomy of the human body, details the equipment necessary for first aid, outlines an organization for this purpose and gives instructions for the treatment of common injuries, including electric shock.

MAGNETIZATION IN IRON.—An article by B. Osgood Peirce, of Harvard University, entitled "The Maximum Value of Magnetization in Iron" has been reprinted from the *Proceedings* of the American Academy of Arts and Sciences. The method and apparatus used in the experiments is described and saturation values of the intensity of magnetization in various kinds of iron are given.

REFLECTING POWER.—Technical Paper No. 196, issued by the Bureau of Standards, Washington, D. C., is entitled "The Diffuse Reflecting Power of Various Substances," by W. W. Coblentz. It gives a summary of previous investigations, describes the apparatus and methods employed, and gives results for the reflecting powers of lamp black, platinum black, green leaves, pigments and miscellaneous substances; also the selective reflection emission of white paints.

ELECTRIC SIGN JOURNAL.—The *Electric Sign Journal* has made its bow to the commercial advertising field with its October issue. The publication is to be devoted to illuminated advertising displays. The first issue contains a number of articles of definite interest to those devoted to the development of the electric sign, together with news items respecting the use of electrical advertising in various parts of the country. It is published by Lloyd E. Brown at 315-321 South Warren Street, Syracuse, N. Y.

NEW INCORPORATIONS.

BOSTON, MASS.—Parker Carbureter Company has been incorporated by George E. Parker, Kenneth F. Parker and John T. Clark, the capital stock being $250,000. W.

NEW YORK, N. Y.—Neuland Electrical Company, Incorporated, has been granted articles of incorporation. The capital stock is $100,000 and the incorporators are H. S. Gould, of New York City; A. H. Neuland, S. A. Moss and C. R. Peel, all of Chicago, Ill.

PEORIA, ILL.—Manufacturing and dealing in lightning rods and light fixtures are among the objects of the Struthers Manufacturing Company which has been incorporated with capital stock of $200,000. The incorporators are Reuben F. Struthers, John H. Owens and Arthur M. Otman. Z.

NEW YORK, N. Y.—Removable Letter Sign Corporation has been incorporated with a capitalization of $100,000 for the purpose of manufacturing electric advertising and display signs. The incorporators are David A. Russell, Robert B. Forrester, New York City; and Clarence B. Fortier, Garden City, N. Y.

SYRACUSE, N. Y.—Kiesewetter-Kenney Company, Incorporated, has been granted articles of incorporation to engage in the electrical contracting business. The capital stock is $2,500 and the incorporators are Alexander E. Oberlander and Blanche I. Kenney, of Syracuse; and August Beckert, of Salina, N. Y.

NEW YORK, N. Y.—E. R. Mason Company, Incorporated, has been granted articles of incorporation for the purpose of manufacturing electrical tools and implements. The capital stock is $30,000 and the incorporators are Edward R. Mason and James Burke, of New York City; and Bernard Rountree, of Oradell, N. J.

CONCORD, N. H.—The Cushman Electric Company of this city has filed papers of incorporation. This is a new company to take over the former Cushman Electric Company that was incorporated under the laws of Maine. The capital stock is placed at $100,000. The incorporators are Benjamin A. Kimball, Abe L. Cushman, Henry A. Kimball, Benjamin W. Couch and Luther W. Durgin.

PROPOSALS.

ELECTRICAL SUPPLIES. — Sealed proposals will be received by the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until November 14, for furnishing lead-covered cable, etc., as per Canal Circular 805; and until November 22 for furnishing transformers, switchboards, motor-generator sets, wires and cables, conduits and miscellaneous electrical apparatus, as per Canal Circular 806. Blanks and general information may be obtained from the General Purchasing Officer or from any of the Assistant Purchasing Officers located in the large cities of the United States.

MOTOR-DRIVEN EXHAUST FAN. —Bids will be received November 14 by the Engineer Depot, U. S. Army, Washington Barracks, D. C., for furnishing ventilating blowers ready to run sets, and 18-inch motor-driven exhaust fans. The schedule calls for eight ventilating blowers connected to 110-volt alternating current, single-phase motors, right hand; 2 ventilating blowers connected to 110-volt direct current motors, left hand; 2 18-inch disk or propeller fan, direct connected to 110-volt alternating current single-phase motors, complete with solder; and four 18-inch disk or propeller fans direct connected to 110-volt direct current motors, complete with main switch. Address Joseph E. Kuhn, lieutenant colonel corps of engineers, U. S. Army.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until November 27 for the electric conduit and wiring and interior lighting fixtures for the post office at Kalamazoo, Mich., until December 2, of a one-story building for the post office at Newport, Ark.; until December 8 of a one-story building for the post office at Mishawaka, Ind.; until December 10 of a two-story building for the post office at Morristown, Tenn.; until December 11 of a three-story building for the post office at Pocatello, Idaho; and until December 19 of a two-story building for the post office at Duquoin, Ill., in accordance with drawings and specifications, copies of which may be obtained from the office of the Supervising Architect or the custodians of the various sites.

FINANCIAL NOTES.

Th Fort Dodge, Des Moines & Southern Interurban Railway was sold at a receivership sale on October 31 to Rollin B. Fisher, representing the Old Colony Trust Company, of Boston, for $3,800,000. This is said to mean that the bondholders will retain control of the road. The minor properties and other effects of the road brought $100,500.

The Napa Valley Electric Company has received permission from the California Railroad Commission to acquire the property of the Calistoga Electric Company and to issue $20,500 bonds, $15,300 stock and $5,000 notes. The proceeds from the sale of the securities are to be used to take over the Calistoga properties and to provide for extensions and improvements in the company's facilities.

A call has been made by the directors of the Philadelphia Electric Company for $5 per share on the stock, payable on December 1 to stock of record November 20. The new assessment will make the stock $22.50 paid. The directors also declared an extra stock dividend of $1.50 a share, which is payable December 1 to stock of record November 20.

It is announced that more than $27,000,000 of the $30,000,000 Interborough Rapid Transit Company first and refunding-mortgage five-per-cent bonds, which were taken by bankers a few weeks ago, have been sold. The bonds were offered at 98.5. The unsold balance amounts to $2,750,000.

Western States Gas & Electric has sold $100,000 first and refunding five-per-cent bonds to E. H. Rollins & Company. Western States Gas & Electric is a subsidiary of the Standard Gas & Electric, and these bonds, due in 1941, are part of an authorized amount of $10,000,000, of which $4,257,000 are outstanding. They are junior to $418,000 prior liens. Net earnings of the company are in excess of twice the interest requirements. The bonds are being sold on a 5.60 basis.

The United States Light & Heating Company reports for the year ended on June 30 gross sales of $3,318,584. Net earnings amounted to $346,930 and the total surplus at the close of the fiscal period was $542,027. Treasurer W. S. Crandall submitted that the new year was entered into with a large volume of orders on hand. It had been found necessary, he said, to increase the facilities of the factory at Niagara Falls so as to double its productive capacity for making an electric starter for automobiles. The buildings put up were financed through loans with deposit banks.

At a meeting of stockholders of the Eastern Pennsylvania Power Company and of the Pennsylvania Utilities Company the plan for the merging of the two companies into a new company, the Pennsylvania Utilities Company, was approved. The capitalization is placed at $1,000,000 common and $1,000,000 preferred stock. The merger was approved by Governor Tener on October 30 and letters patent were ordered to be issued to the new company. Following this the directors of the company held a meeting and approved the authorization of a $25,000,000 mortgage by the new company. It is understood that part of these bonds will be issued to pay off the outstanding indebtedness of the old companies and the remainder of the issue will be held for future improvements and additions. A meeting of stockholders has been called for December 30, 1913, at which time they will be asked to approve the new issue. The capitalization of the old Pennsylvania Utilities Company was $85,000, which was owned by the eastern Pennsylvania Power Company. The capitalization of the latter company was $3,500,000 common and $1,000,000 preferred, which was controlled by the Atlantic Gas & Electric Company through stock ownership. Officers of the new company are: Carl M. Phil, president; A. D. Lord, vice-president; F. B. Shannon, treasurer, and A. B. Cheadle, secretary.

Dividends.

American District Telegraph Company of New York; a quarterly dividend of one per cent, payable November 15 to stock of record November 1.

Detroit United Railways Company; quarterly of 1.5 per cent, payable December 1 to stock of record November 15.

Ohio Traction Company; quarterly of 1.25 per cent on preferred payable November 1 to stock of record October 27.

Reports of Earnings.

NEW YORK STATE RAILWAYS.

The report of the New York State Railways to the Up-State Public Service Commission, for the quarter ended June 30, 1913, compares as follows:

	1913.	1912.
Gross	$1,966,299	$1,891,934
Net after taxes	603,421	571,915
Other income	35,414	36,835
Total income	638,834	608,750
Surplus after charges.	335,876	345,737

CONEY ISLAND & BROOKLYN.

The Coney Island & Brooklyn Railroad Company has issued its report for the year ended June 30, 1913. The income account compares as follows:

	1913.	1912.
Operating revenue	$1,646,603	$1,415,133
Net after taxes	528,443	324,308
Other income	19,411	31,235
Total income	547,854	355,543
Interest and rent	329,306	329,647
Net corporation income	*218,548	25,896

*Equal to 7.32 per cent earned on $2,983,900 capital stock as compared with 0.86 per cent on same stock previous year.

INTERBOROUGH RAPID TRANSIT.

	1913.	1912.
September gross	$2,596,719	$2,442,320
Net after taxes	1,409,056	1,239,490
Other income	44,148	33,361
Total income	1,453,204	1,272,851
Surplus after charges.	519,304	352,259
Three months' gross..	7,287,335	7,042,881
Net after taxes	3,707,196	3,392,885
Other income	127,752	89,770
Total income	3,834,948	3,482,655
Surplus after charges.	1,037,620	723,990
Passengers carried	141,943,588	136,940,132

LEHIGH VALLEY TRANSIT.

	1913.	1912.
September gross	$ 164,620	$ 136,191
Net after taxes	105,021	83,407
Surplus after charges..	57,797	40,246
Twelve months' gross.	1,739,737	1,461,503
Net after taxes	1,009,067	825,455
Surplus after charges.	461,429	329,874

PHILADELPHIA RAPID TRANSIT.

	1913.	1912.
September gross	$1,999,343	$1,926,043
Net	845,277	798,889
Surplus after charges.	44,275	36,850
Three months' gross..	5,965,988	5,758,078
Net	2,463,432	2,328,732
Surplus after charges..	64,785	51,411

KINGS CO. ELECTRIC LIGHT & POWER.

	1913.	1912.
September gross	$ 443,749	$ 401,617
Net after taxes	148,316	118,401
Other income	5,125	4,964
Total income	153,441	123,364
Surplus after charges.	82,750	47,097
Nine months' gross	4,073,972	3,767,514
Nine months' net	1,506,630	1,310,908
Other income	48,555	42,425
Total income	1,555,184	1,353,333
Surplus after charges.	894,680	691,582

VIRGINIA RAILWAY & POWER.

	1913.	1912.
September gross	$ 414,861	$ 394,964
September net	197,620	201,330
Surplus after charges.	73,448	84,173
Three months' gross..	1,293,476	1,211,034
Three months' net..	633,792	598,173
Surplus after charges.	260,199	250,678

ROCKFORD ELECRTIC.

	1913	1912
Gross earnings	$451,276	$407,627
Net after taxes	235,869	193,617
Surplus after charges..	140,351	99,716

SCRANTON ELECTRIC.

	1913	1912
Gross earnings	$876,057	$788,045
Net after taxes	526,259	438,158
Surplus after charges..	340,888	291,111

WHEELING ELECTRIC.

	1913	1912
Gross earnings	$299,725	$251,183
Net after taxes	138,649	123,550
Surplus after charges..	73,140	71,220

AMERICAN POWER & LIGHT.

American Power & Light reports consolidated earnings of subsidiary companies as follows for September, three months ended September 30, and twelve months ended September 30:

	1913	1912
September gross	$ 482,677	$ 441,148
Net after taxes	231,086	198,123
Three months gross	1,389,480	1,264,098
Net after taxes	656,590	554,618
Twelve months gross..	5,665,809	5,259,001
Net after taxes	2,550,455	2,358,862

REPUBLIC RAILWAY & LIGHT.

	1913	1912
September gross	$ 250,813	$ 224,137
Net after taxes	99,790	92,066
Surplus after charges.	55,705	48,092
Nine months gross	2,192,175	1,926,296
Net after taxes	849,681	754,829
Surplus after charges.	443,810	357,386

SAN JOAQUIN LIGHT & POWER CORPORATION.

The San Joaquin Light & Power Co. reports for the eight months ended Aug. 31, 1913, as follows:

	1913	1912
Gross earnings	$1,125,170	$848,712
Net after taxes	617,731	497,779
Surplus after charges.	345,013	248,923

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Nov. 3.	Oct. 27
American Tel. & Tel. (New York)	120⅞	121¾
Commonwealth Edison (Chicago)	139⅛	135
Edison Electric Illuminating (Boston)	264½	263
Electric Storage Battery common (Philadelphia)	46	47¼
Electric Storage Battery preferred (Philadelphia)	46	47¼
General Electric (New York) (ex-dividend)	140½	140⅝
Kings County Electric (New York)	119	119
Manhattan Transit (New York)	1¼	1¼
Massachusetts Electric common (Boston)	11½	11
Massachusetts Electric preferred stamped (Boston)	67¼	67
National Carbon common (Chicago)	133	132½
National Carbon preferred (Chicago)	114¾	113
New England Telephone (Boston)	139¼	140
Philadelphia Electric (Philadelphia)	22½	22⅜
Postal Telegraph and Cables common (New York)	78	77
Postal Telegraph and Cables preferred (New York)	63	63
Western Union (New York)	63	62½
Westinghouse common (New York)	66½	65
Westinghouse preferred (New York)	110	110

PERSONAL MENTION.

MR. N. I. GARRISON, auditor of the Western States Gas & Electric Company at Stockton, Cal., is appointed auditor for the Fort Smith Light & Traction Company, Fort Smith, Ark.

MR. VAL A. FYNN, consulting engineer for the Wagner Electric Manufacturing Company, St. Louis, Mo., has returned from his summer's sojourn in Europe. Mr. Fynn has as wide a reputation as a mountain climber and guide as he has for his many achievements in the single-phase motor field.

MR. H. C. HOAGLAND has been appointed general manager and treasurer of the Fort Smith (Ark.) Light & Traction Company, vice MR. J. W. GILLETTE, resigned. Mr. Hoagland will also retain his position as general manager of the Muskogee (Okla.) Gas & Electric Company, of Muskogee, Okla.

MR. A. J. REED, recently connected with the Dayton office of the Westinghouse Electric & Manufacturing Company, has severed his connections with that company to assume duties with the Robbins & Myers Company, Springfield, O., in the capacity of manager of the newly opened branch office in Cleveland, O.

MR. V. B. BERGENTHAL, assistant sales manager of the Wagner Electric Manufacturing Company, has been appointed purchasing agent of the company. Mr. Bergenthal is a graduate of the University of Wisconsin, and received his engineering degree in 1897. After graduation he went with the Stanley-General Incandescent Company at Pittsfield, Mass., and later was located in its Western office at Chicago. Since 1904, Mr. Bergenthal has been with the Wagner Electric Manufacturing Company.

MR. GEORGE W. GANO, heretofore in the electrical inspection department of Marsh & McLennon, insurance brokers, of Chicago, has been appointed superintendent of the electrical department of the Kentucky Actuarial Bureau, at Louisville, Ky. The department has been organized for the purpose of making a more complete inspection of risks from the standpoint of electrical hazards. The chief idea is to do educational work as to the importance of proper electrical construction to eliminate fire hazards.

MR. A. NORMAN, formerly manager of the Freeport (Ill.) Railway & Light Company, has been appointed manager of the Eugene division of the Oregon Power Company, with headquarters at Eugene, Ore., effective November 15. In this capacity he succeeds MR. R. M. JENNINGS, who becomes manager of the Oregon Power Company, at Marshfield, Ore. MR. D. C. GREENE, at present manager at Marshfield, will become manager of the Everett (Wash.) Gas Company, December 1, vice MR. H. H. STEPHENS, resigned.

MR. ZENAS W. CARTER has been appointed manager of sales for the Ensign Manufacturing Company, Boston, Mass. This company is the manufacturer of the Ensign electric calculating machine, which Mr. Carter states handles multiplication, addition, division and subtraction as quickly as electricity can move it. Mr. Carter recently resigned as secretary of the New England Electrical Development Association, which subsequently disbanded in view of the organization and recent working out of the plans of the Society for Electrical Development.

MR. HOMER E. NIESZ, formerly general manager of the Cosmopolitan Electric Company, Chicago, which has recently been consolidated with the Commonwealth Edison Company, has been appointed secretary of the Budget and Expense Committee of the latter organization. The Budget and Expense Committee of the Commonwealth Edison Company composes President Insull's cabinet, and is made up of the heads of the various departments of the company. Mr. Niesz's position is one requiring great executive ability, and a wide knowledge of the operation of a big organization. Mr. Niesz is well qualified by experience and natural talent to accept this important post. Prior to taking up his work actively, Mr. Niesz is spending a two weeks' vacation at Hot Springs, Va.

MR. EDWARD J. NALLY, vice-president and general manager of the Marconi Wireless Telegraph Company of America, has returned to the United States after a visit to the principal high-power stations of the company at Clifden, Ireland, and Carnarvon and Towyn, Wales. The latter two stations are to be ready by January 1, 1914. New high-power stations of the same type are being erected near San Francisco and in the Hawaiian Islands for trans-Pacific service with the Orient. A station will soon be completed in Japan and it is planned to construct similar stations in the Philippines and China. Mr. Nally states that work will soon begin on a high-power station near Boston to work with a similar station now being built by the Norwegian Government to handle traffic to northern Europe. Stations will also be built in Brazil, Argentina, and other places in South America.

MR. JOHN M. ROACH, on November 3, presented to the Board of Directors his resignation as president of the Chicago Railways Company. At the request of the Board, Mr. Roach will remain a director and continue active connection with the company in the capacity of advisor to the management. MR. HENRY A. BLAIR, chairman of the Board of Directors, was elected president, succeeding, Mr. Roach. Mr. Blair is now in full direction of all the affairs of the company. Mr. Roach had been connected with the old North and West Chicago street railroads for about 40 years. He rose from conductor to general manager under C. T. Yerkes, and is one of the last of the old Yerkes regime. He continued with the company after Yerkes sold out, and was made president of the Chicago Railways Company when it came into control of the two old systems.

MR. GEORGE W. DANFORTH, assistant chief of the Department of Machinery Exhibits of the Panama-Pacific International Exposition, is making a trip from San Francisco to the eastern part of the United States, visiting the manufacturers of all classes of electrical machinery that have been in correspondence with the department with regard to an exhibit at the 1915 exposition. Mr. Danforth was in Chicago during the week, and reported that the prospects were excellent for a most remarkable exhibit of electrical and kindred machinery, and that the state of advancement of the buildings was something unprecedented in exposition work. A large part of the electrical energy for the motive power and illumination of the exposition will come from the hydroelectric stations in the mountains of California under contract with the Pacific Gas & Electric Company. There will, however, be a 5,000-kilowatt alternating-current steam-driven turbogenerator equipment made up of exhibit material. Oil-fired boilers will be used exclusively. There will also be a 1,500-kilowatt direct-current exhibit installation which will be driven for the most part by crude-oil internal-combustion engines of the Diesel type. The installation will be under the direction of the Pacific Gas & Electric Company. The exposition is making a rate of three cents per kilowatt-hour as a motor rate, so as to induce as large a moving exhibit as possible.

OBITUARY.

MR. GRAFTON R. STEVENS, a well known consulting engineer, was burned to death at a fire which consumed his home at Wilmette, Ill., on October 30. The fire resulted fatally also to Mrs. Stevens. For a number of years Mr. Stevens was employed with H. M. Byllesby & Company, of Chicago. Early this year he left the company to go into business for himself as consulting engineer and to promote and operate several electric light plants in Iowa. Mr. and Mrs. Stevens spent the evening of October 30 visiting friends, and upon returning to their home found the building in flames. They entered the burning structure intent upon saving some of their valuables and keepsakes, and were caught in the falling building before a rescue was possible.

FOREIGN TRADE OPPORTUNITY.

(Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C. In applying for addresses refer to file number.)

NO. 11,925. MACHINERY FOR CARBON AND METAL WIRE MAKING.—A report from an American consul states that an engineer in his district desires the names of American firms which install machinery for carbon and metal wire making for wire lamp factories and firms manufacturing glass bulbs and lighting wire.

DATES AHEAD.

Electrical Credit Association of Chicago. Annual meeting, Chicago, Ill., November 14.

National Academy of Science. Autumn meeting, Johns Hopkins University, Baltimore, Md., November 18-19.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Columbus, O., November 20-22.

American Society of Refrigeration Engineers. Annual meeting, New York, N. Y., December 1-2.

American Automobile Association. Richmond, Va., December 1-3.

American Society of Mechanical Engineers. Annual meeting, New York, N. Y., December 2-5.

National Gas Engine Association. Toledo, O., December 4-6.

American Institute of Chemical Engineers, New York, N. Y., December 10-13.

American Association for the Advancement of Science. Annual meeting, Atlanta, Ga., December 29-January 3, 1914.

Western Association of Electrical Inspectors. Annual meeting, Cincinnati, O., January 27, 1914.

With the Electrical Manufacturers

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., announces that the mining-machinery department has been moved from Chicago to the West Allis works near Milwaukee.

George C. Richards Company, 629 West Jackson Boulevard, Chicago, has been appointed sales representative for the Atlantic Insulated Wire & Cable Company for the Central Western States.

The Steel City Electric Company, Pittsburgh, Pa., announces the appointment of the Ohio Distributing Company, Hearst Building, Chicago, as its sales representative in the Central Western States.

Railway & Industrial Engineering Company, Pittsburgh, Pa., has issued a circular briefly describing its disconnecting switches for indoor and outdoor mounting. The switches are of the triple-pole type.

Rush Brothers Company, 136 West Lake Street, Chicago, has issued a circular briefly referring to the Rush sanitary white porcelain lighting fixtures. Illustrations of a few of these fixtures both of the ceiling and bracket type are shown, also a few of the indirect lighting bowls.

George Cutter Company, South Bend, Ind., manufacturer of electric lighting fixtures, and distributing apparatus, has opened an eastern office at 258 Broadway, New York City, F. X. Cleary is in charge, making this his headquarters for the territory covered by the New England, Middle Atlantic and Southern Atlantic States.

Central Electric Company, 320 South Fifth Avenue, Chicago, has issued a new discount and price book for its catalog No. 28. The new price book alone covers 112 pages. Included in it are a number of illustrations and descriptions of products recently added to the Central line and not covered by the latest catalog.

Delta-Star Electric Company, Chicago, Ill., has issued a very complete bulletin describing and illustrating high-tension busbar and wiring supports. With the standard units listed over 7,000 combinations are possible, thus greatly simplifying high-tension stations and switchboard wiring. Copies of this bulletin will be furnished to those interested upon request to the company.

Multi Refillable Fuse Company, 817 Washington Boulevard, Chicago, Ill., announces that Redge Harvey, 1310 Majestic Building, Detroit, has taken the agency for its line for the state of Michigan, and is pushing sales aggressively. The company also announces the appointment of the Intermountain Sales Company, 1711 Wazee Street, Denver, Colo., as its agent in the central western territory.

The Walker Electric Company, 2318 Noble Street, Philadelphia, Pa., has issued edition B of its catalog of switchboard supplies and accessories. This catalog covers over 40 pages and lists various types of knife switches, switch parts, aluminum fuses, rheostat parts, switchboard brackets, supports, etc. There is also included an illustrated description of the Walker remote-control rheostat mechanism and of the Walker motor mechanism for large valves.

The United States Light & Heating Company, Niagara Falls, N. Y., announces the removal of its New England sales office, formerly located at 84 State Street, to 25 Irvington Street, Boston, Mass. This change brings the New England service station and sales office under one roof, an arrangement which it was deemed feasible to make because of the greater opportunity afforded for close co-operation between the two departments. The change was also necessitated on account of the increase in business.

Holophane Works of General Electric Company, Cleveland, O., is continually adding to the already great variety of its products in the line of illuminating glassware. In a portfolio recently prepared on new Holophane products there are illustrated no less than 16 ornamental glass portable lamps of Veluria and cut glass. A number of new designs for ceiling fixtures, both in the line of direct lighting and of bowls for semi-indirect lighting have also been added. These are all of artistic pattern and of such variety as will harmonize with many kinds of interior decoration.

Universal Portland Cement Company, Chicago, Ill., has had reprinted a paper entitled "Concrete in Mine Construction," by A. F. Allard, chief engineer, Bunsen Coal Company, Danville, Ill. This paper points out the great value of the use of concrete in various buildings connected with a mine, as well as for various purposes within the mine itself. The permanency of this material and its exceptional fireproof qualities are of particular value in minimizing the dangers from fires and other accidents in a mine, and also in decreasing the maintenance cost to a minimum.

Crane & Lieberknecht are opening an experimental laboratory and manufactory for the production of specialized scientific apparatus and electrical appliances, at 226 Cypress Street, Brookline, Mass. The company is installing high-grade machinery with which to turn out school and college experimental equipment, and the purpose is to elaborate on inventors' ideas and develop new electrical devices with a view to their becoming patented and commercialized. Mr. Crane for five years past has been connected with the scientific department of Harvard University, and Mr. Lieberknecht was for two years instructor in electrical engineering at Harvard.

The Cutter Company, Philadelphia, Pa., has issued an attractive and unique publication entitled "Who's Who and What's What," celebrating 25 years of the company's business. The history of the organization and the development of its push-button switches and I-T-E circuit-breakers are narrated. The most striking feature of the publication is the series of 26 brief biographical sketches of the company's executive officers and department heads, ranging from President A. Edward Newton to the mysterious Mr. X. Y. Z. in charge of the order department. Each of these sketches is accompanied by an excellent portrait of the official it refers to. This unique publication is bound to make the many patrons of the company better acquainted with the personnel of its staff.

Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, Ill., has issued catalog No. 27 on Union stamped-steel switch and outlet boxes. This new catalog contains 32 pages, in which the material described in the previous catalog on the subject has been carefully revised and brought up to date. Among additions to the line of Union boxes and accessories are several new forms adapted to concrete work, also several four-inch square covers and four-inch and 3.25-inch round covers for shallow boxes and ceiling plates. Illustrations of a few of the many possible uses of the Universal box are shown and the advantages of the beveled-corner switch boxes are also described. There is also given a list of corresponding numbers of boxes made by other manufacturers.

H. W. Johns-Manville Company, New York, N. Y., has recently received a contract from the Corn Exchange National Bank, of Philadelphia, for the complete equipment of its counting room with the Frink and J. M. Linolite system of lighting; this contract amounts to over $10,000. The company claims that this system gives an exceptionally evenly diffused light for the entire working surface. The source of the light is completely screened from the eye. Many banks that have installed this equipment state that it has been an important factor not only in increasing the working capacity of its entire office force but also in facilitating the detection of counterfeit bills. An illustrated booklet dealing with this system of lighting can be obtained on application to the company.

Machinenfabrik Oerlikon, Oerlikon, near Zurich, Switzerland, has published No. 72 of its periodical bulletins, this particular one dealing with low-voltage automatic circuit-breakers. The bulletin is illustrated with various types of these devices arranged for overload, underload, reverse-current and no-voltage control and also for automatic opening on the presence of a foreign current. Several combined types embodying two of these features are also made. Each of the types is described

in considerable detail. Dimension diagrams and other data relating thereto are also included in the bulletin. In pamphlet No. 577 this company describes its single-phase commutator motors with shunt characteristics for the operation of elevators. These machines are of compact design and are readily arranged for reversal. The bulletin describes their characteristics with the aid of numerous diagrams and points out their advantages, particularly for elevator service, where simplicity of equipment is essential. Bulletin No. 73 deals with motor-driven trolley-type traveling hoists. These are operated either from the floor through cords or by an operator in a cage mounted directly beneath the hoisting equipment. These machines are made in a variety of forms and sizes ranging up to a lifting capacity of four tons. Some of them can be hung on the hook of the traveling crane. Bulletin No. 578 deals with motor-driven centrifugal blowers. Either direct-current or alternating-current motors are supplied in these units and the motor and blower are mounted together on the same base so as to make a compact and relatively light-weight unit. Some of these sets are mounted in boxes together with their control equipment, so as to make them readily portable.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued No. 17 of its periodical publication called "Small Motors." This particular number deals almost exclusively with Westinghouse electrical equipment for electric vehicles. The bulk of the bulletin is given up to a description, with the aid of many diagrams and half-tone illustrations, of the Westinghouse vehicle motors. Equipments for charging vehicle batteries are also briefly described. In the latest issue of *The Textile Quarterly* of the Westinghouse Company, electrically driven pickers form the main subject of discussion. This pamphlet describes and illustrates in detail four methods for driving these machines. There are also given illustrated descriptions of motors adapted to this service, also a number of graphic meter curves showing the load on this type of machine. In section No. 3133, issued by the industrial and power department of the company, the subject of motor-driven refrigerating and ice-making machinery is treated in a concise manner, including much interesting information on the subject and specific data on motor applications, with kilowatt-hour consumption for different plants. A curve is also shown of the horsepower required for refrigerating machines of different capacities. Section 3195 deals with motor-driven dairy, creamery and ice-cream machinery; this pamphlet gives a large amount of data on the installation of motors and shows views of typical sets. Folder 4266 deals with the electric breakfast set made by the company. This includes the Westinghouse toaster stove and pot-type coffee percolator; it is stated that the total time required for the preparation of a breakfast is 15 minutes and the cost of the current is two cents. Folder 4241 is devoted to Westinghouse alternating-current watt-hour meters; it describes and illustrates these meters and shows load curves of different types thereof.

General Electric Company, Schenectady, N. Y., announces that among a multitude of recent orders for generating, transmission and power apparatus the following were noteworthy: Winooski Valley Power Company, Essex Junction, Vt., four 1,500-kilowatt, alternating-current generators, a 100-kilowatt motor-generator set, seven 1,000-kilowatt water-cooled transformers, switchboard and accessories. Hannawa Falls Water Power Company, Potsdam, N. Y., 450-kilowatt, alternating-current generator, two 2,000-kilowatt water-cooled transformers and switchboard panels. Beaver River Power Corporation, Beaver Falls, N. Y., two 1,500-kilowatt, alternating-current generators with 26-kilowatt exciters, three 1,500-kilowatt water-cooled transformers, switchboards and accessories. Northern Power Company, Canton, N. Y., three 1,000-kilowatt, water-cooled transformers and a switchboard. Wisconsin River Power Company, Madison, Wis., a 2,800-kilowatt water-cooled transformer. American Steel & Wire Company, Cleveland, O., 400-horsepower and 600-horsepower motors. Republic Iron & Steel Company, Youngstown, O., thirteen motors, ranging from 10 to 350 horsepower and control panels. Forged Steel Wheel Company, Butler, Pa., two 500-kilowatt two-unit motor-generator sets, four 200-kilowatt and four 750-kilowatt transformers and a switchboard. Republic Iron & Steel Company, Thomas, Ala., a 400-kilowatt motor-generator set, a 250-kilowatt synchronous motor, five 150-kilowatt transformers, seven motors, ranging from 5 to 100 horsepower, a switchboard and accessories, and four eight-ton electric industrial locomotives. Bethlehem Steel Company, South Bethlehem, Pa., 31 motors, ranging from 2 to 10 horsepower. Otis Steel Company, Cleveland, O., 31 motors, ranging from 12 to 80 horsepower. Ludlow Manufacturing Company, Ludlow, Mass., a 2,500-kilowatt Curtis turbo-alternator with 60-kilowatt motor-generator exciter set, four 730-kilowatt transformers, switchboards and accessories. American Printing Company, Fall River Mass., a 250-kilowatt 600-volt generator with 25-kilowatt generator and 35-kilowatt motor-generator exciter sets, rheostats, regulators, switchboard panels, etc. Singer Manufacturing Company, New York City, maker of sewing machines, a 5,000-kilowatt, 2,300-volt Curtis turbo-alternator for the plant at Elizabethport, N. J. E. C. Lewis, Incorporated, Boston, Mass., electrical contractor, two 200-kilowatt rotary converters, two 220-kilowatt transformers, a 30-kilowatt Tirril regulator and switchboard for the Commonwealth Pier station to supply power to hoisting machinery for loading and unloading freight. California Portland Cement Company, Los Angeles, Cal., 13 75-horsepower and six 150-horsepower motors, switchboard and accessories. Farr Alpaca Company, Holyoke, Mass., a 2,000-kilowatt Curtis turbo-alternator with switchboard and accessories. National Lead Company, Port Richmond, Staten Island, N. Y., 20 motors, ranging from 5 to 50 horsepower. Buda Company, Harvey, Ill., manufacturer of railway supplies, a 100-kilowatt motor-generator set, 50 motors, ranging from one-half to 75 horsepower, switchboard and accessories. Pennsylvania Feldspar Company, Rochester, N. Y., a 115-kilowatt, synchronous motor with 4.5-kilowatt exciter, four induction motors from 7.5 to 50 horsepower, switchboard, etc. International Harvester Company, Chicago, Ill., four transformers, 17 motors, ranging from 7.5 to 35 horsepower and switchboard. S. Sanford & Son, Amsterdam, N. Y., 65 induction motors, ranging from one to fifty horsepower.

Record of Electrical Patents.

Issued by the United States Patent Office, October 28, 1913.

1,076,665. Regulating Valve. G. W. Collin, assignor to Collin Valve Co., Bridgeport, Conn. Includes a solenoid for operating the controlling valve.

1,076,668. Time Register. L. H. Friedman, Norfolk, Va. Associated with a clock mechanism on the dash of an automobile is an electromagnetic recorder for the control lever.

1,076,672. Vapor Rectifier for High-Potential Circuits. J. L. R. Hayden, assignor to General Electric Co. A special bulb construction for a mercury-arc rectifier.

1,076,754. Safety Appliance for Electrical Installations. W. F. Force, Flatbush, N. Y., assignor of one-half to E. B. Latham. A special fuse support for receiving cartridge fuses end-on.

1,076,788. Trolley. J. J. Sabo, Pittsburgh, Pa. Has guard fingers over the trolley wire.

1,076,789. Primary Battery. A. L. Saltzman, assignor to New Jersey Patent Co., West Orange, N. J. A special U-shaped sheet-metal hanger for supporting the electrode plates.

1,076,798. Automatic Stopping Device for Lace Looms. T. Thompson, Pawtucket, R. I., assignor of one-half to W. H. Smith. Displacement of a catch bar closes the circuit of a stopping-latch electromagnet.

1,076,806. Generator for Ignition Purposes. B. Ames, Lowell, Mass. Includes a make-and-break device and a condenser.

1,076,848. Lamp-Shade Holder. S. B. Van Ranst, assignor to Crouse-Hinds Co., Syracuse, N. Y. Portions of the expansible collar fitting around the lamp socket are of shorter radii than the normal radius of the collar.

1,076,856. Steel Tower. R. L. Allen, assignor to Archbold-Brady Co., Syracuse, N. Y. A structural A-frame tower for transmission lines.

1,076,858. Electric Heater. W. S. Andrews, assignor to General Electric Co. The resistance is wound on a quartz rod and the whole is inclosed in a quartz tube.

1,076,870. Conduit Fish-Wire Machine. B. Dahl, Minneapolis, Minn. A reel for the fish wire has a radially moving wire guide on the adjoining stationary disk.

1,076,873. Manufacture of Incandescent Filaments. G. Dobkevitch, assignor to Société Internationale de la

Lampe Electrique O. R., Paris, France. The filament is metallized, heated in an atmosphere of hydrogen and ammonia, and then surrounded with an atmosphere of inert gases.

1,076,874. Process of Making Insulating Fabric. G. F. Dreher, assignor to General Electric Co. Consists in moistening a number of adjacent asbestos rovings, brushing them so as to make them unite and form a continuous fabric, and then apply adhesive to the fabric.

1,076,884. Vapor Rectifier for High-Potential Circuits. J. L. R. Hayden, assignor to General Electric Co. A mercury rectifier with an auxiliary electrically heated graphite anode to absorb foreign gases.

1,076,887. Electric Melting Furnace. L. E. Howard, assignor to Simonds Mfg. Co., Fitchburg, Mass. Polyphase furnace with the secondaries connected to the hearth.

1,076,896. Electric Signaling System. C. E. Lee, Chicago, Ill., assignor of one-half to B. C. Sammons. Includes motor-operated actuators for the make-and-break contacts.

1,076,907. Lock Attachment for Snap Switches. C. D. Platt, Bridgeport, Conn. The operating spindle can be locked by a key.

1,076,927. Battery Holder. G. N. Waterbury, Jr., Washington, D. C. A case with removable top and connections for dry cells.

1,076,943. Lighting and Ignition Device. J. Berg, assignor to Metal Specialties Mfg. Co., Chicago, Ill. A handle with electric lamp at the end, a branch socket at the side and separate push-buttons for each socket.

1,076,944. Telegraphic Perforating Receiver. H. Bille, Copenhagen, Denmark. A motor-driven cam disk actuates punches and electromagnets operated by signal currents select the punches for actuation.

1,076,949. Valve Tube. E. W. Caldwell, New York, N. Y. A self-regulating Villard type vacuum tube with a small-area anode chamber and a large-surface cathode consisting of a focusing portion in the form of a spherical cathode cup.

1,076,969. Pneumatic-Despatch-Tube Apparatus. E. A. Fordyce, assignor to Lamson Co., Newark, N. J. Includes an electrically operated valve.

1,076,980. Stop Motion. F. H. Hall, assignor to W. Firth, Chestnut Hill, Mass. Electromagnetically controlled.

1,076,987. Pneumatic-Despatch-Tube Apparatus. J. G. Maclaren, assignor to Lamson Co. Electric means for normally keeping the blower unloaded until a carrier is admitted.

1,076,990. Telephone System. C. W. McGonigle, assignor to Globe Telephone Co., Seattle, Wash. The local instruments are connected to the main line through transformers.

1,077,002 and 1,077,003. Spark Plug. A. Schmidt, assignor to Champion Ignition Co., Flint, Mich. Cover construction details.

1,077,008. Vacuum Cleaner. J. W. Smith, assignor to H. Small and C. A. Duren, Philadelphia, Pa. An electric motor is mounted in a separate compartment directly above the base.

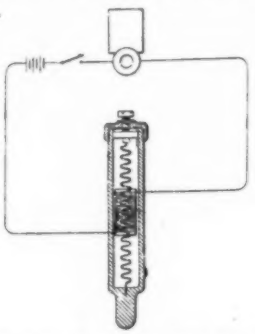
1,077,018. Trolley. S. G. Valles, Habana, Cuba. Has special contact brushes on each side of the wheel.

1,077,024. Automatic Electric Regulator. P. Werner and E. Juillard, assignors to Ateliers H. Cuénod Société Anonyme, Châtelaine, near Geneva, Switzerland. An electric governor for a cylindrical fluid valve.

1,077,035. Electric Water Heater. R. C. Boyer, Lincoln, Neb. Has superposed coils.

1,077,038. Automatic Controlling Device for Electrically Heated Apparatus. B. W. Brawner, Augusta, Ga. Thermostatic circuit-breaker.

1,077,075. Organ Stop Mechanism.



1,077,096—Electrical Apparatus for Treating Deafness.

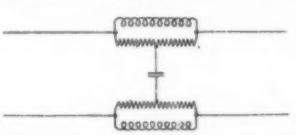
R. Hope-Jones, North Tonawanda, N. Y. An electrically operated musical instrument.

1,077,077. Electric Protective Device for Safe and Vault Doors. H. Huhn and H. R. Huhn, assignors to Yale & Towne Mfg. Co., Stamford, Conn. Combination time-lock mechanism and electric alarm.

1,077,096. Apparatus for Use in the Treatment of Deafness. A. Rosenberg, London, England. For enabling communication to the ear of electrically produced undulatory mechanical vibrations through a plug inserted in the external auditory canal. (See cut.)

1,077,140. Submarine Cable. F. Jacob, assignor to Siemens & Halske A-G., Berlin, Germany. Comprises a number of conductors, an artificial self-inductive load thereon, and insulation composed of balata closely surrounding each of the conductors.

1,077,147. Trolley Wheel or Sheave.



1,077,163—Line Protection Against Excess Voltage.

A. E. Lineberg, Wilkes-Barre, Pa. Has inwardly extending peripheral projections.

1,077,163. Means for Protecting Electric Circuits from Excessive Rises in Pressure and Similar Disturbances. R. Rüdenberg, assignor to Siemens-Schuckertwerke, G. M. B. H., Berlin, Germany. A concentrated inductance and resistance in parallel are inserted in each side of the line and a concentrated capacity is connected between points of the resistances. (See cut.)

1,077,175. Storage-Battery Power and Charging Equipment. C. H. Thordarson, Chicago, Ill. Connected with several storage batteries are automatic potential switches for connecting a discharged battery to the charging circuit and a charged battery to the discharge circuit.

1,077,179. Electromagnetic Motor. A. J. V. Wilson, Atlanta, Ga., assignor of one-third to C. C. Hudson. A permanent horseshoe magnet rotates about an electromagnet.

1,077,185. Party-Line System for Automatic Telephone Exchanges. F. Aldendorff, assignor to Western Electric Co. An automatic switching system has line-selecting devices and ringing-circuit selectors.

1,077,192. Automobile Lamp. T. P. Driver, Melrose, Mass. An electric-lamp holder and switch.

1,077,225. Telephone-System Station Instrument. A. E. Keith, assignor to Automatic Electric Co., Chicago, Ill. An automatic hand telephone with receiver and calling dial at one end of the handle and transmitter at the other end.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patend Office) that expired November 3, 1913.

570,446. Globe for Electric Arc Lamps. M. B. Bailey, Chicago, Ill.

570,452. Bracket for Pendent Electric-Light Globes. J. Christiansen and R. W. Pittman, Hartford, Conn.

570,454. Galvanometer. C. Coleman, Chicago, Ill.

570,476. Door-Opening or Closing Apparatus for Elevators. F. E. Herdman, Winnetka, Ill.

570,481. Instrument for Measuring Electric Currents. R. M. Hunter, Philadelphia, Pa.

570,496. Magnetic Separator for Threshing Machines. E. H. Osborn, Des Moines, Iowa.

570,508. Electric Alarm Bell. R. Segerdahl, Chicago, Ill.

570,517. Incandescent Lamp and Socket. A. Swan, New York, N. Y.

570,554. Electrodeposition. E. Jordis, Munich, Germany.

570,565. Electric Railway. H. C. Reagan, Jr., Philadelphia, Pa.

570,566. Magnetic Patch for Underground Electric Railways. H. C. Reagan, Jr., Philadelphia, Pa.

570,599. Return Circuit for Electric Railways. G. Kapp, Berlin, Germany.

570,616. Burglar Alarm. F. Steinkoenig, Sioux City, Iowa.

570,619. Process of Manufacturing Plates for Secondary Batteries. C. H. Weise, Possneck, Germany.

570,663. Method of and Apparatus for Regulating Dynamo-Electric Generators or Motors. J. W. Easton, Brooklyn, N. Y.

570,738. Electromagnetic Warp Stop-Motion for Looms. A. C. Shuttleworth, Philadelphia, Pa.

570,773. Telephone Switch. C. N. Sandbeck, Harmony, Minn.

570,808. Safety Switch. E. Joel and W. M. Christian, Vienna, Austria.

570,823 and 570,824. Electric Arc Lamp. H. A. Seymour, Washington, D. C.

570,825. Carbon for Arc Lamps. D. A. Shesler, Toledo, O.

570,827. Electrically Controlled Elevator. S. D. Strohm, Philadelphia, Pa.

570,840. Automatic Telephone System. M. Brooks, Minneapolis, Minn.

570,845. Substance for Telephone Electrodes. D. Drawbridge, Eberly's Mills, Pa.

570,852. Type-Printing Telegraphic Apparatus. F. H. W. Higgins, London, England.

570,878. Multiple-Series Controller. J. F. McElroy, Albany, N. Y.

570,882. Automatic Safety Device for Electric Circuits. L. G. Rowand, Camden, N. J.